NOVEMBER 28, 1955

Electrical World

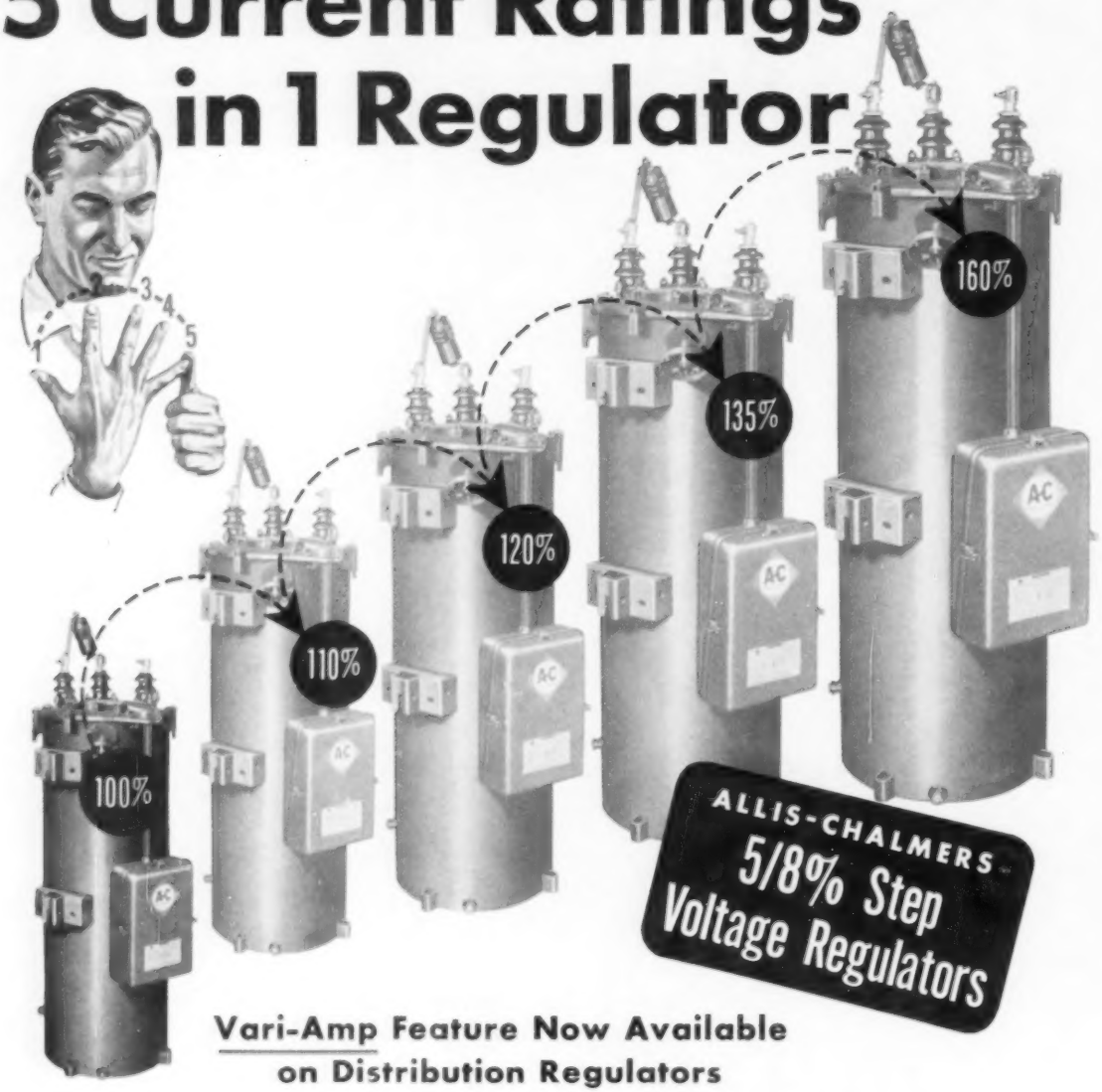
Price 35 Cents

A McGRAW-HILL PUBLICATION

Kentucky WELCOMES INDUSTRY

How Underground Systems

5 Current Ratings in 1 Regulator



Vari-Amp Feature Now Available on Distribution Regulators

YOU GET MORE USES FROM A SINGLE REGULATOR now that Allis-Chalmers provides increases in current ratings of as much as 60%. The *Vari-Amp* feature provides convenient stops that limit the range to let you handle more load.

The *Vari-Amp* feature provides considerable flexibility. You can reduce ranges in 1¼% steps from ±10% down to ±5%, increasing current-carrying capacity in steps up to 160%. Range need not be equal in both directions. Set what you need — for example, 6½% raise at 135% current, 10% lower at 100% current.

Best of all, this convenient feature that gives so many more uses for a voltage regulator comes at no extra cost. It gives you more for your regulator dollar because you get a lot more from a single regulator.

Get the complete story by calling your nearby A-C district office. Or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-4803

Originators of 5/8% Step Regulation

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Electrical World

Published for 81 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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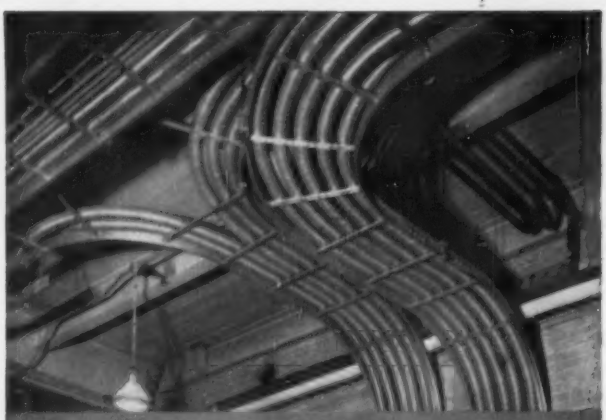


INDOORS

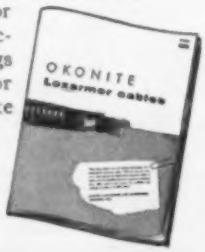
OUTDOORS

rubber-insulated LOXARMOR CABLES save space, reduce cost

Considerable interest is growing throughout industry in Loxarmor (interlocked armor) Cables for use in locations where the maximum protection of a rigid conduit is not required. Okonite's interlocking Loxarmor covering makes the cable flexible and easy to train (minimum bending radius 8 times cable O.D.) and at the same time provides mechanical sturdiness. Installation costs are lower than for rigid conduit systems, and Loxarmor's accessibility makes it easier and cheaper to reroute or add circuits. Its compactness provides important space-saving features where runs must be installed around existing plant equipment. Loxarmor coverings can be supplied in galvanized steel, aluminum, bronze or copper.

Okonite rubber-insulated Loxarmor Cables are insulated with Okonex, a butyl-base compound applied by Okonite's famous strip-insulating process. Vulcanized in a metal mold, the insulation forms a solid dielectric wall which has better moisture resistance and electrical properties than laminated varnished cambric insulations. The superiority of Okonex is indicated by its higher insulation resistance, lower dielectric loss, lower power factor and lower specific inductive capacity.

Okonex-insulated Loxarmor Cables are suitable for operation up to 15,000-volts and at conductor temperatures up to 85C. For complete information on Okonite Loxarmor Cables, including detailed splicing and terminating drawings and instructions, write for Bulletin EW-1090. The Okonite Company, Passaic, N. J.



Available with either copper or aluminum conductors

OKONITE OKONITE SINCE 1878 ***insulated cables***

2976

10,000 FEET OF CONDUIT RODDED IN 8 HOURS!

Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

EASY DOES IT!—It's all in a day's work with Electroline Steel Duct-Rodding Equipment rodding 10,000 feet of conduit!

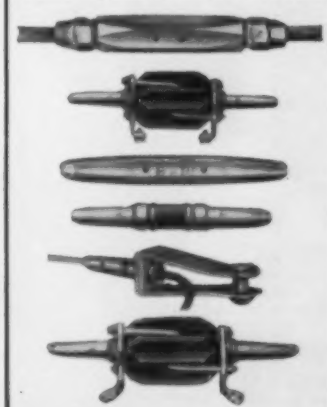
Light in weight, easily handled and stored, low upkeep: these are a few of the advantages utility men know to be true. But even bigger, more important advantages are—

- *Savings in the cost of labor*—for example, where it formerly took two gangs from one to two weeks on a given job, one gang, *in one-half hour*, has completed the same job—using Electroline Duct-Rodding Equipment.
- *Savings in original cost*—you get long life—double that of other types—when you buy Electroline Duct-Rodding Equipment. Add to that this fact: this equipment costs just about half as much for equivalent capacity! *There's true economy.*
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.

OTHER *Electroline* PRODUCTS



Electroline Company

4121 South La Salle St., Chicago 9, Ill.
In Canada: POWERLITE DEVICES, LTD., TORONTO

FLORIDA POWER & LIGHT SELECTS S&C POWER

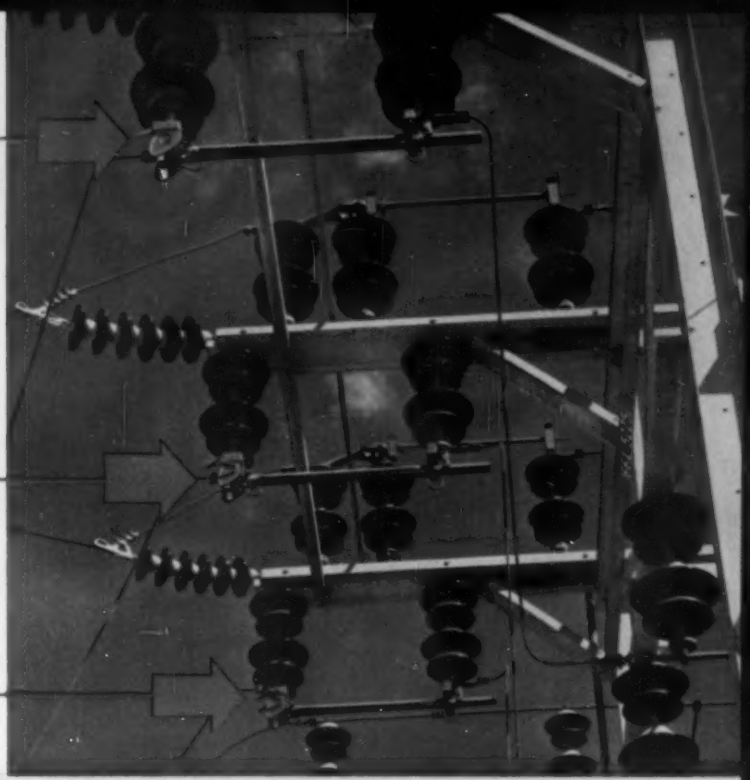
Florida Power & Light Company is the Sunshine State's fastest growing utility. Year after year more manufacturers, more businesses, and more commercial enterprises are moving into the territory it serves. Rapid population gains have increased customers by 138%, and more than tripled demands on the Florida Power & Light system since the end of World War II.

To satisfy these demands, Florida Power & Light has carried on an extensive power expansion program which, by the end of 1955, will have required the investment of $250,000,000 since V-J Day.

For an expansion program of such importance, it is only natural that the greatest possible care is used to make sure that service continuity is maintained and system equipment is protected.

Aerial view of the Hialeah section of Miami—one of the areas where rapid building of homes and industry has increased demand for light and power to six times what it was ten years ago. Hialeah Park is nationally famous . . . open the year around . . . host to hundreds of thousands annually.

COMPANY FUSES



For example, S&C Drop-Out Power Fuses—Type SMD (marked by arrows, right) are installed at Hialeah substation to protect two 7500 kva 69/13 kv transformers which serve Hialeah Park as well as the hundreds of homes and many small industrial plants which surround it.

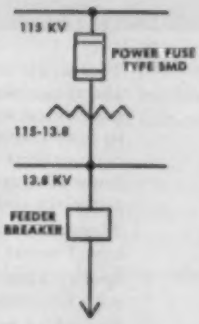
How S&C Power Fuses Are Used in the 69 Kv and 115 Kv System Protection Schemes

The transmission lines of Florida Power & Light Company are tapped at intervals to feed distribution substations. As was originally planned, the power transformers were not always provided with primary protection against secondary faults since primary breakers could not be economically justified.

After a 115 kv power transformer had been lost (for lack of such protection) the matter of protection was reconsidered. It was then decided that this protection was essential and that the device selected must meet these special requirements.

1. Provide system protection over a wide range of fault currents.
2. Coordinate with the transformer damage curve to provide maximum protection to the transformers.
3. Give complete coordination with secondary protective devices over the full range of fault currents.
4. Be capable of withstanding the recovery voltages which might be encountered under various fault conditions.
5. Be low in cost.

S&C Power Fuses, Type SMD, were found to meet all these requirements. Further details of Florida Power & Light's application of these fuses may be found in AIEE Paper No. DP 55-405.



Typical substation tapped directly from Florida Power & Light's transmission lines.

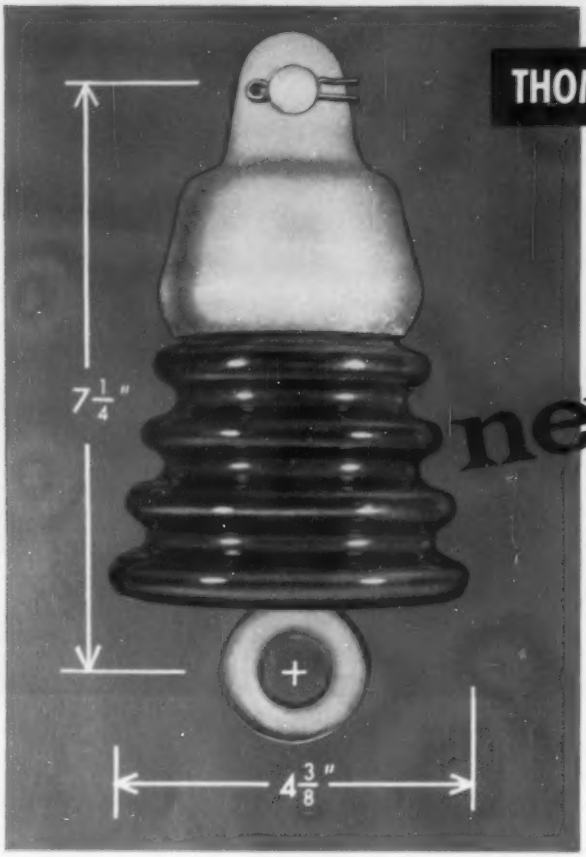
Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

4421 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR



THOMAS *Best by line test*

new design

1 for 2

RUGGED-TYPE GROOVED STRAIN INSULATOR

This single unit does the work of *two* 6" or one 10" conventional disc-type unit and is used for dead-ending voltages up to and including 12 Kv. Its superior mechanical and electrical characteristics effect a very substantial reduction in dead-ending cost. Note the smooth lines formed by the outer edges of the corrugations and forged steel cap—no porcelain projections to receive the brunt of rough handling. If dropped, impact is distributed uniformly over porcelain and cap . . . reduces danger of breaking.

Thousands of units are giving satisfactory performance. Reports indicate that the new Thomas design is superior to any previous dead-ending unit.

Specify Thomas Catalog No. 1315 Rugged-Type Grooved Strain Insulators with full confidence that their quality and value cannot be surpassed.

Packed 12 per carton in Thomas "PACKT-TO-STACK" modern cartons. Write for prices and sample today.

Engineering Characteristics

Flashover—Dry-65 Kv., Wet-35 Kv., M & E Strength—10,000 Lbs., Leakage Distance—7½ Inches.

The R. Thomas and Sons Co.

1873 THOMAS INSULATORS our 82nd year RELIABILITY 1955

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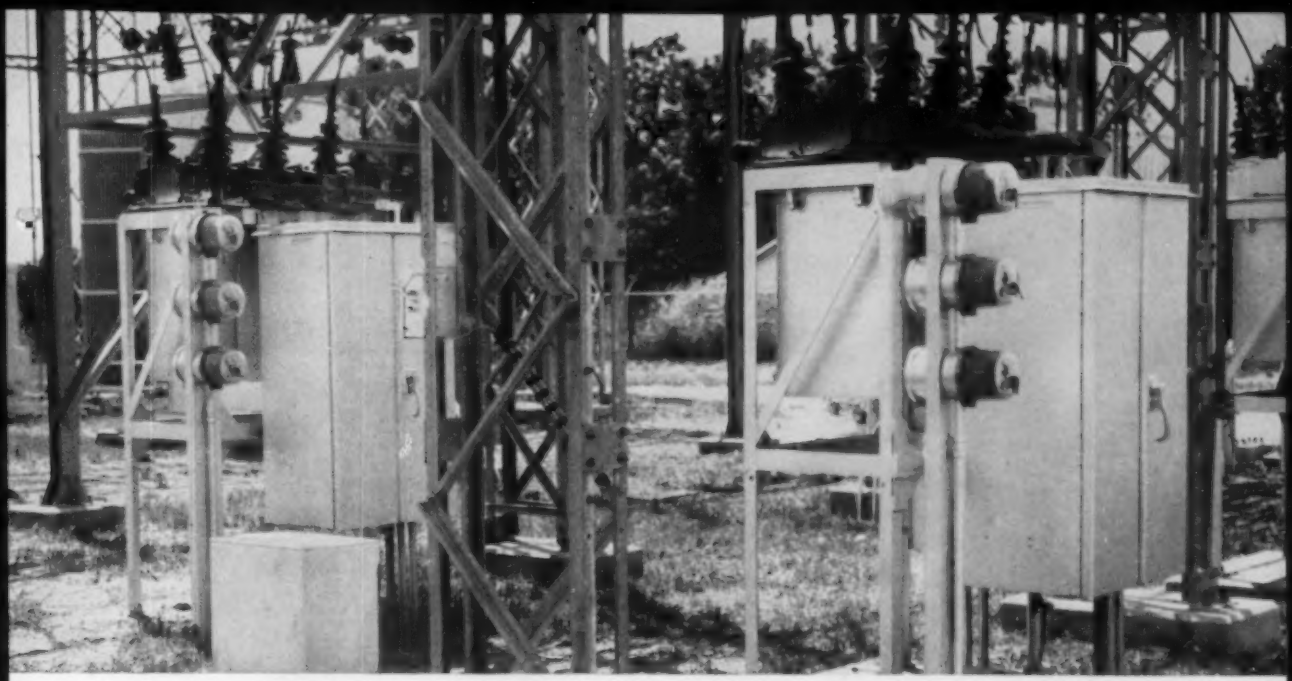


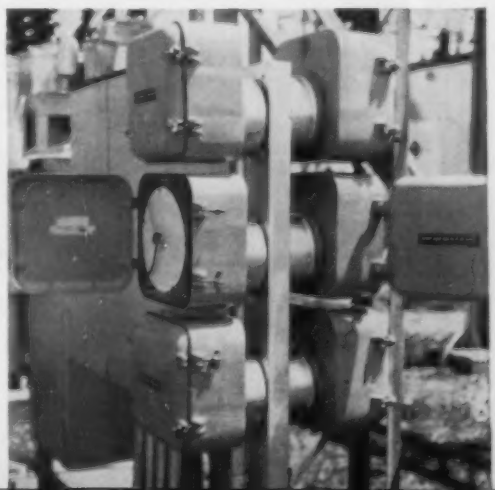
Overall view of substation showing socket-installed Lincoln ammeters and voltmeters on two circuits.

LICK LOADING PROBLEMS WITH LINCOLN METERS

flexible, fool-proof, low cost method gives complete substation measurement

This permanent installation of ammeters shows loading and balance on phases.

Reactive and Kilowatt Lincoln Demand Meters in paired sockets correlate kvar and kw data.



Now, you can get simplified measurement for system operation — at your substations —by means of a permanent installation of meter sockets and the use of various types of Lincoln "Indicating Meters with a Memory." You can secure detailed knowledge of circuit operation by "plugging in" Lincoln Graphics to obtain time of occurrence and duration of system conditions.

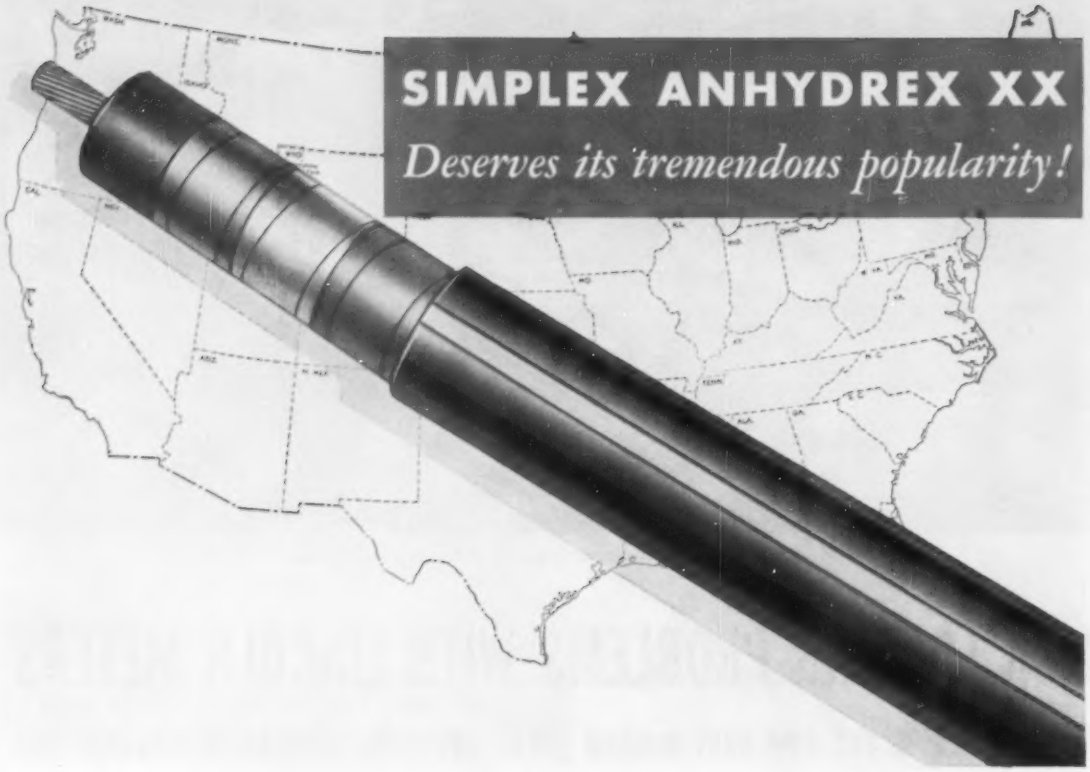
Socket type meters to measure amperes, volts, vars, or kw can be installed in any of the sockets. Any lineman can make the installation, since no wiring changes are necessary. The socket makes the correct connection for the meter "plugged in."

Write today for full information on Lincoln Meters and Simplified Measurement for System Operation.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

SM55-A



SIMPLEX ANHYDREX XX

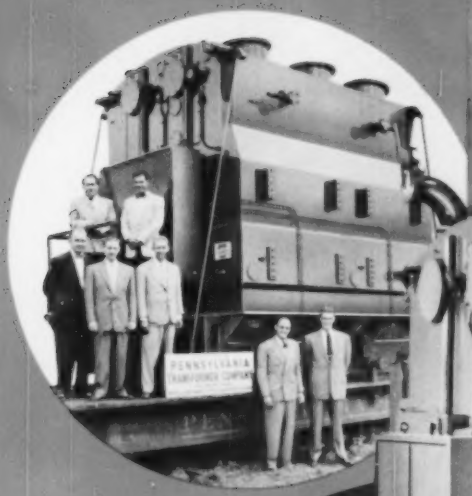
Deserves its tremendous popularity!

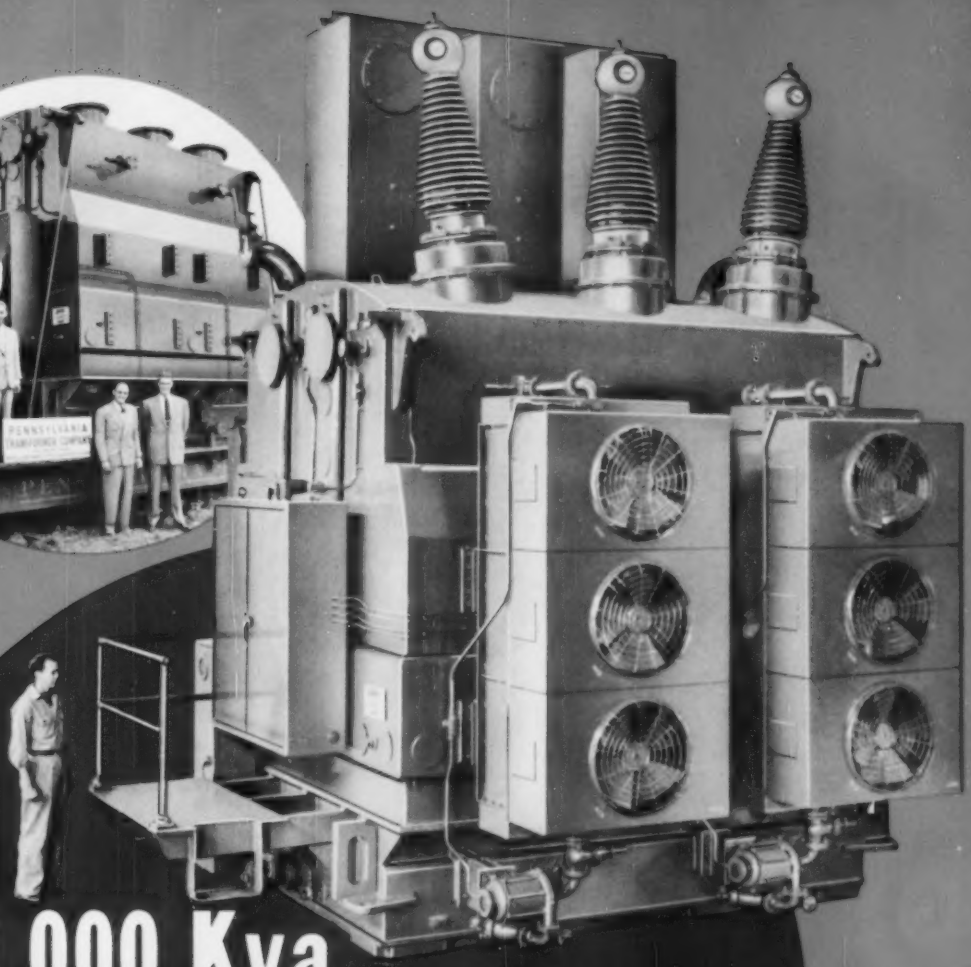
- Simplex-ANHYDREX XX insulation is made for cable operating at 3kv to 25kv and over.
- It resists heat, ozone, oxidation and water even AFTER *aging for 7 days at 250°F.*
- Rated at 85°C. to 15kv and at 80°C. above that, it's used in ducts, overhead on messenger wires, or underground.
- ANHYDREX XX eliminates need of a lead sheath.
- It eliminates problems of oil migration, sheath creeping, corrosion, electrolysis, bonding and joint wiping.
- ANHYDREX XX-insulated cable is lighter and more flexible than lead-covered cable.
- ANHYDREX XX Cable is made with a tough neoprene jacket, submarine armor wire, or other suitable outer covering.

Simplex Bulletin 1009A tells more about ANHYDREX XX high voltage insulation. Write for it today.

Simplex **ANHYDREX XX CABLE**

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.





120,000 Kva

THREE PHASE • CONTOUR DESIGN

Pennsylvania Power Transformer

Two 120,000 Kva Pennsylvania generating station transformers are connected to a 200,000 Kw generator of an Eastern utility. Their function is to step up the generated voltage of 19,800 volts to 145,000 volts for transmission around a metropolitan area. Each transformer arrived at the generating station in an upright position, completely assembled except for bushings and forced-cooling equipment. Transformer oil is cooled through four forced-oil to forced-air heat exchangers. The transformers were designed to operate during flood water levels up to four feet above transformer bases. Platforms provide accessibility to cabinets.

PENNSYLVANIA TRANSFORMER COMPANY

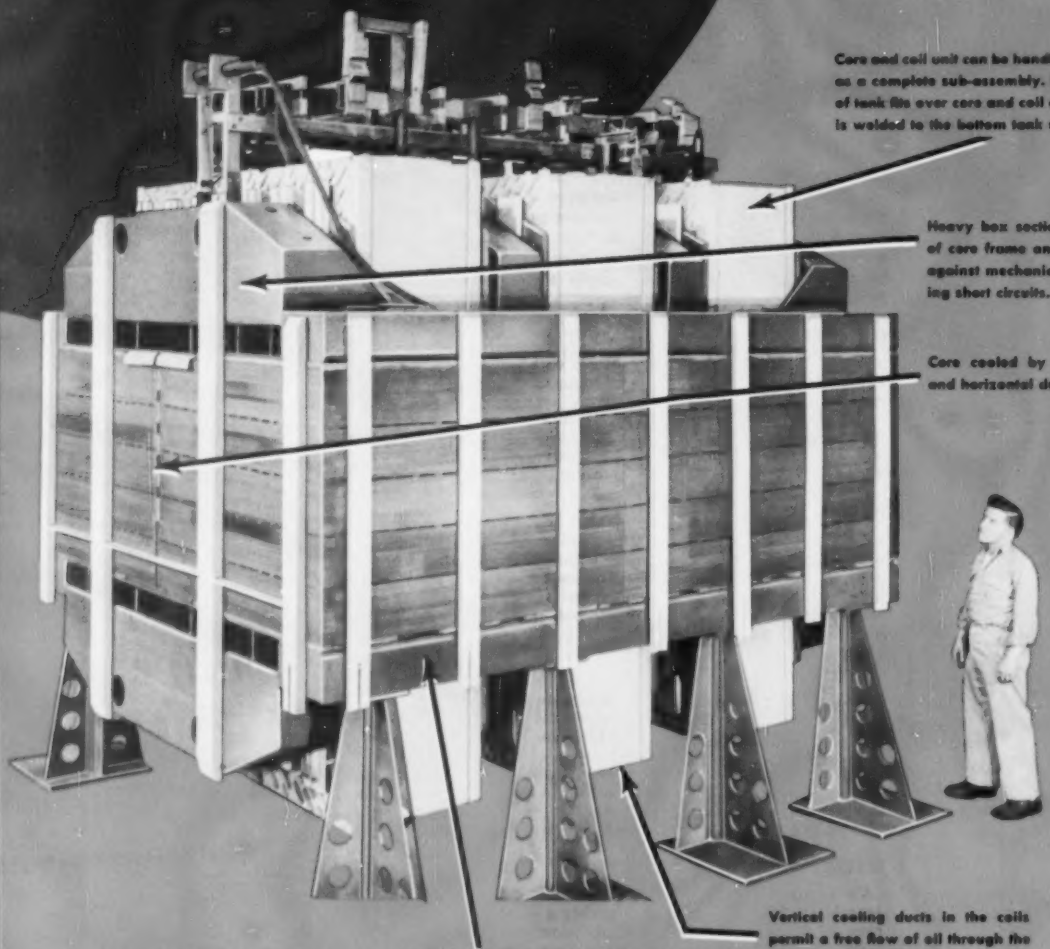
A McGraw Electric Company Division

CANONSBURG, PENNSYLVANIA • ***Greater Pittsburgh District***

SEE NEXT PAGE FOR INSIDE STORY →

inside a 120,000 Kva Pennsylvania Power Transformer

• THREE PHASE CONTOUR DESIGN



Core and coil unit can be handled separately as a complete sub-assembly. Upper section of tank fits over core and coil assembly and is welded to the bottom tank section.

Heavy box sections form part of core frame and clamp coils against mechanical forces during short circuits.

Core cooled by both vertical and horizontal ducts.

Vertical cooling ducts in the coils permit a free flow of oil through the coils for most efficient cooling.

Core and coil assembly is designed to rest on bottom section of Contour Design tank.

120,000 Kva, Three Phase, 60 Cycles, 55° C. Temperature Rise. Forced-oil with forced-air heat exchangers. High voltage: 145,000 Grd.Y volts. Low voltage: 19,800Δ volts.

PENNSYLVANIA TRANSFORMER COMPANY

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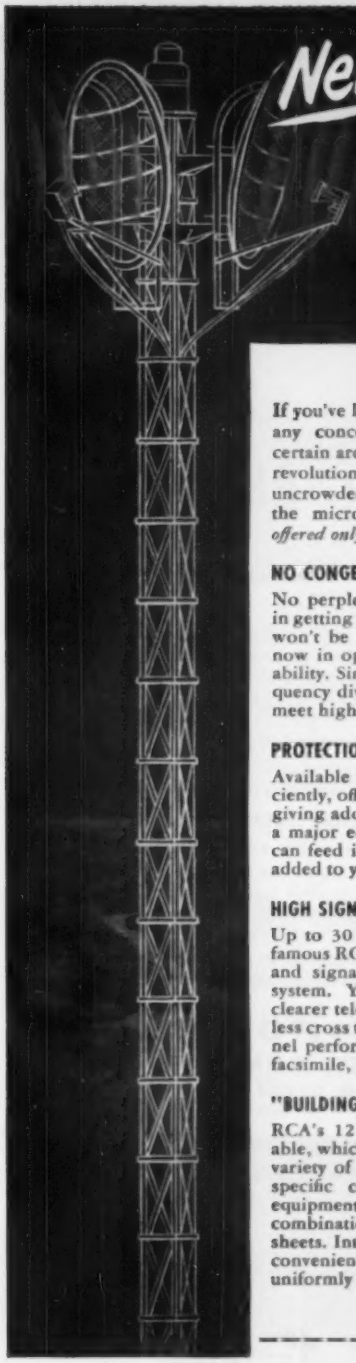
For exterior view of this transformer, see other side.



New CONGESTION-FREE MICROWAVE SYSTEM

Now offered You by RCA for the Uncrowded 2450-2700 mc Band

If you've hesitated about Microwave because of any concern about spectrum congestion in certain areas, you'll welcome news about RCA's revolutionary MM-26. First to operate in the uncrowded 2450-2700 megacycle portion of the microwave spectrum, this new system, *offered only by RCA* means:

NO CONGESTION—PEAK DEPENDABILITY

No perplexing engineering problems to solve in getting your system oriented. And your system won't be subject to interference from systems now in operation, thus providing all-time reliability. Single side band suppressed carrier frequency division multiplex is used exclusively to meet highest standards of dependability.

PROTECTION AGAINST OBSOLESCENCE

Available frequency space is utilized most efficiently, offering more systems in one band, thus giving added protection against obsolescence—a major economic advantage. The new system can feed into existing RCA systems and so be added to your present equipment.

HIGH SIGNAL-TO-NOISE RATIO

Up to 30 high-performance voice channels of famous RCA quality, or several hundred teletype and signalling channels are provided in one system. You get high signal-to-noise ratio, clearer telephone conversations, less distortion, less cross talk. You can expect better voice channel performance, dependable telemetering and facsimile, all-weather performance.

"BUILDING-BLOCK" ADAPTABILITY

RCA's 12 basic units are readily interchangeable, which means you can put together a wide variety of stations, each designed to provide a specific combination of facilities. You get equipment exactly to your specifications, each combination being clearly explained on catalog sheets. Integrated operation of all units assures convenience and versatility in system planning, uniformly high performance.

EASY INSTALLATION—SERVICING

Conventional triode tubes, unregulated power supply, familiar circuits, obviate the need for specially trained personnel. Tuning is simplified because the frequency is controlled from the terminal through the entire system.

Microwave is today's most modern form of radio for private communications systems. A radio beam carries communications and control signals from one place to another, following a narrow line-of-sight path. RCA was one of the first to pioneer in Microwave. Today its installations cover the nation and the globe. Only RCA systems provide so many advanced engineering features. Microwave specialists will be glad to answer any questions and plan your installation. Mail Coupon below for further particulars.

New stylized racks with doors feature modern functionalized design and open back for ease of servicing. Open cabinet shows complete Microwave Terminal. Closed rack shows stand-by equipment.

RCA

RADIO CORPORATION of AMERICA

COMMUNICATIONS EQUIPMENT
CAMDEN, N. J.

Radio Corporation of America
Communications Equipment
Department YE-45, Building 15-1, Camden, N. J.

Please send me new booklet on RCA MM-26 Microwave—a system for the uncrowded 2450-2700 mc band, designed for pipelines, utilities, railroads, turnpike, common carrier.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

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HYDRAULIC DERRICK

The new PM-2 offers *more* outstanding operating characteristics than *any* derrick ever made. It utilizes the most desirable features of the famous *HD-2* and *HD-4* Pole-Master Derricks . . . has a unique new design that's destined to set a new standard for fully-powered derricks. You'll like everything about the new PM-2 . . . especially the time and money it saves. Three sizes: for 40′ poles, for 55′ poles, and for 75′ poles.

LOOK AT THESE OUTSTANDING FEATURES:

Completely fool-proof operation • "Live" boom can be moved under load • Operating arc *well in excess* of 180 degrees • Requires only single-drum winch • Head sheave can be threaded from ground • No center leg or exposed mechanism • Does not obstruct cargo area or rear of body • Operated by one double-acting control valve • Permits complete closing of body roof.

McCABE-POWERS

AUTO BODY COMPANY

5900 NO. BROADWAY, ST. LOUIS, MO. 625 CEDAR ST., BERKELEY 10, CALIF.

Bulletins describing Pole-Master Derricks —Series PM-2, Series HD-2, and Series HD-4—will be sent, with price information, upon request. No obligation, of course!

Southwire means service

Fast, dependable Southwire trucks speed the wide variety of Southwire products all over the country—from El Paso to Scranton, from Duluth to Key West—wherever aluminum or copper transmission or distribution conductor is needed.

Many of Southwire's trucks are on regularly scheduled runs, reaching every nook and cranny in an ever-increasing area. This means that shipments reach their destination *on time* and in less time than normally expected.

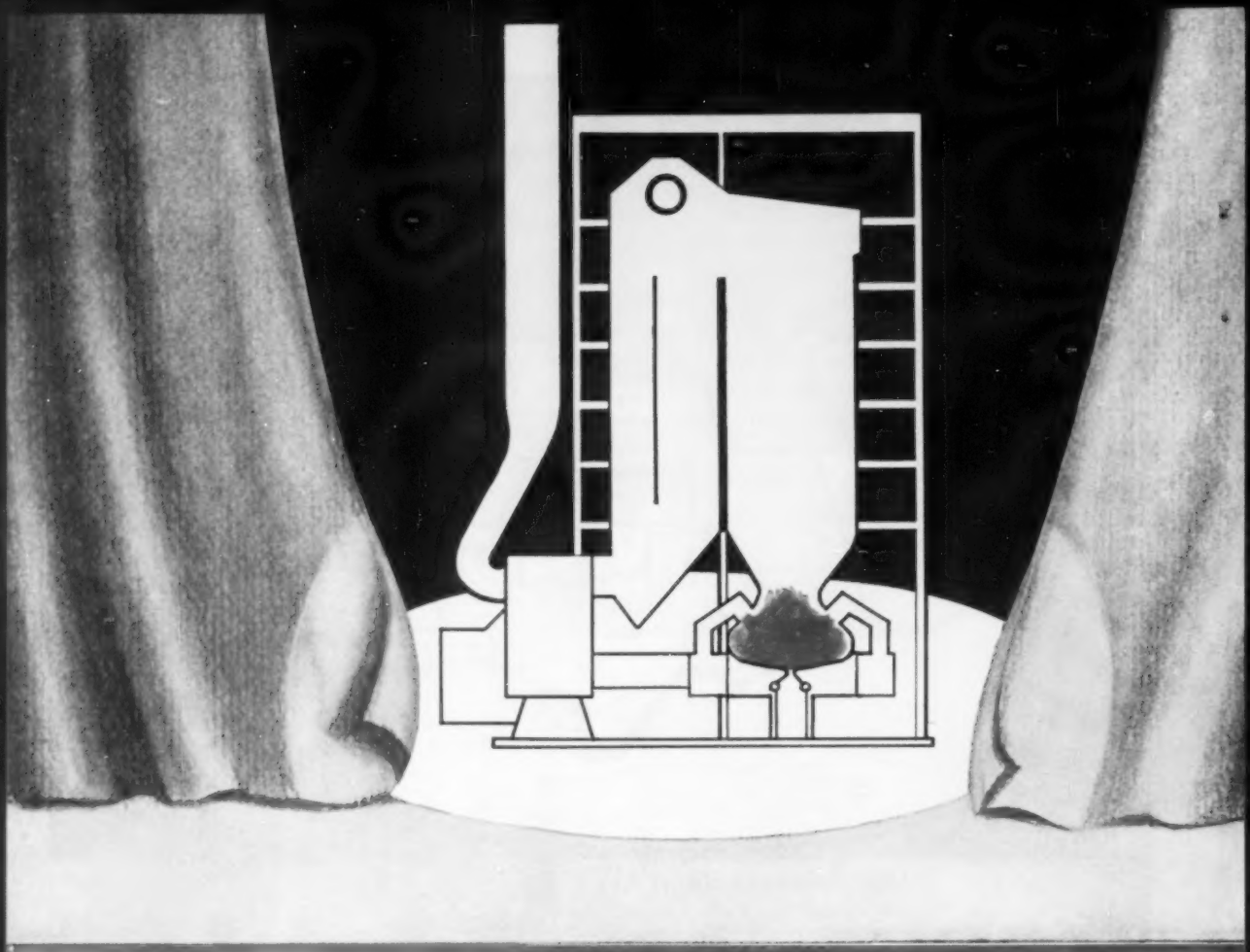
Add the flexibility of Southwire's manufacturing schedules to speedy shipping and you have service with a capital S. You also have the reasons why more and more engineers and purchasing agents are specifying Southwire, and why it will pay you to do likewise.

SOUTHWIRE PRODUCTS

- **Bare and Weatherproof Copper and Aluminum Wire**
- **Neoprene Copper, Aluminum and Triplex**
- **Polyethylene Building Wire**
- **Copperweld® Conductors • ACSR**
- **Steel Strand, plain or galvanized**
- **Aluminum Alloy Wires**
- **Cable Accessories**

Southwire Company

Telephone: TErrace 2-6311 • Carrollton, Georgia



Efficiently uses a wide range of coals . . . oil

With these outstanding advantages:

- No slag blowers required
- Higher efficiency — lower carbon loss
- No stratification of furnace gases
- All burners on one level
- No flyash disposal problem
- The same temperature of gases leaving furnace with any fuel
- No conversion of pressure parts required for change of fuel
- Lower overall height

...gas...lignite...delayed coke...fluid coke

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY
Stoker Corporation
WORCESTER, MASSACHUSETTS

Sales Offices: Worcester, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

UNITS WITH RILEY TURBO FURNACES ARE DESIGNED FOR ANY CAPACITY, PRESSURE, TEMPERATURE

A Few Turbo Furnace Units

ST. CROIX PAPER CO.
One 175,000 lb./hr. Unit, 750 psig, 725F.

CARBIDE & CARBON CHEMICALS CO.
One 175,000 lbs./hr. Unit, 450 psig, 515F.
One 289,000 lbs./hr. Unit, 650 psig, 660F.

DELAWARE POWER & LIGHT CO.
Three 500,000 lbs./hr. Units, 1425 psig, 950F.

TEXAS ELECTRIC SERVICE CO.
One 825,000 lbs./hr. Reheat Unit, 1750 psig, 1005/1005F.

LOUISIANA POWER & LIGHT CO.
One 1,550,000 lbs./hr. Reheat Unit, 2125 psig, 1005/1005F.

Questions and Answers

about the

Pneu-Draulic Circuit Breaker Operator

Pneu-Draulic operators can be furnished on power oil circuit breakers from 14.4 kv, 500,000 kva to the largest.

Following are answers to questions that have arisen during discussions of the *Pneu-Draulic* operator. Perhaps they may answer some of the questions in your mind.

Q. What happens if the accumulator bag breaks?

A. While breakage is unlikely, surprisingly enough the breaker would continue to operate normally for a period of approximately a year. The high pressure oil would slowly absorb the nitrogen charge.

Q. How long will the accumulator bag last?

A. Allis-Chalmers had about ten years' experience with the identical accumulator on rock crushers without replacement. On these units there are about one million flexations of the bag each year.

Q. Can accumulator bladder pressure drop low enough due to extremely cold weather to prevent operator from closing breaker?

A. No. There is enough oil reserve in the reservoir to make up for any drop in nitrogen pressure in the accumulator.

Q. What maintenance will be required?

A. The very minimum. All that is required is that at least once each year the oil level in the reservoir and precharge pressure in the accumulator should be checked.

Q. The control valve is immersed in oil and shouldn't stick — but if it did when the ram was in the top position, could the breaker trip?

A. Since all Allis-Chalmers breakers are mechanically trip-free, the breaker would open at its normal operating speed.

Q. How much oil leakage can be expected?

A. Field experience to date proves no external leakage need be expected. Internal leakage from high to low pressure portion of system will be about .4 cubic inches per hour maximum. This means pump will operate about one minute in 24 hours.

Q. Is there danger to operating personnel if an oil line should break?

A. No more than with an air line in a pneumatic system. However, the greatest safety factors possible have been incorporated. From a pressure standpoint the *Pneu-Draulic* operator meets all requirements of the Joint Industrial Conference on Hydraulics and Army and Navy specifications; safety factor is 5 to 1, based on a 3000-psi system. In addition, a pressure relief valve is incorporated to prevent excessive pressure if pressure switch should fail to shut off pump.

If you have any further questions regarding the *Pneu-Draulic* operator, or would like a copy of the new Bulletin 71B7942, contact your nearby A-C office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4779

Pneu-Draulic is an Allis-Chalmers trademark.

ALLIS-CHALMERS

COMPLICATED?

NOT AT ALL—BECAUSE IT'S ALL CONSTRUCTED WITH COPE STANDARD FITTINGS

another example of

Cope

efficiency

MARTINS FERRY PLANT
of Wheeling Steel Corporation,
Martins Ferry, Ohio.
EQUIPMENT DESIGNER
& MANUFACTURER:
The
Wean Engineering Co., Inc.
ELECTRICAL CONTRACTOR:
The Dingle-Clark Co.

...using the exclusive "Pin-Coupler"

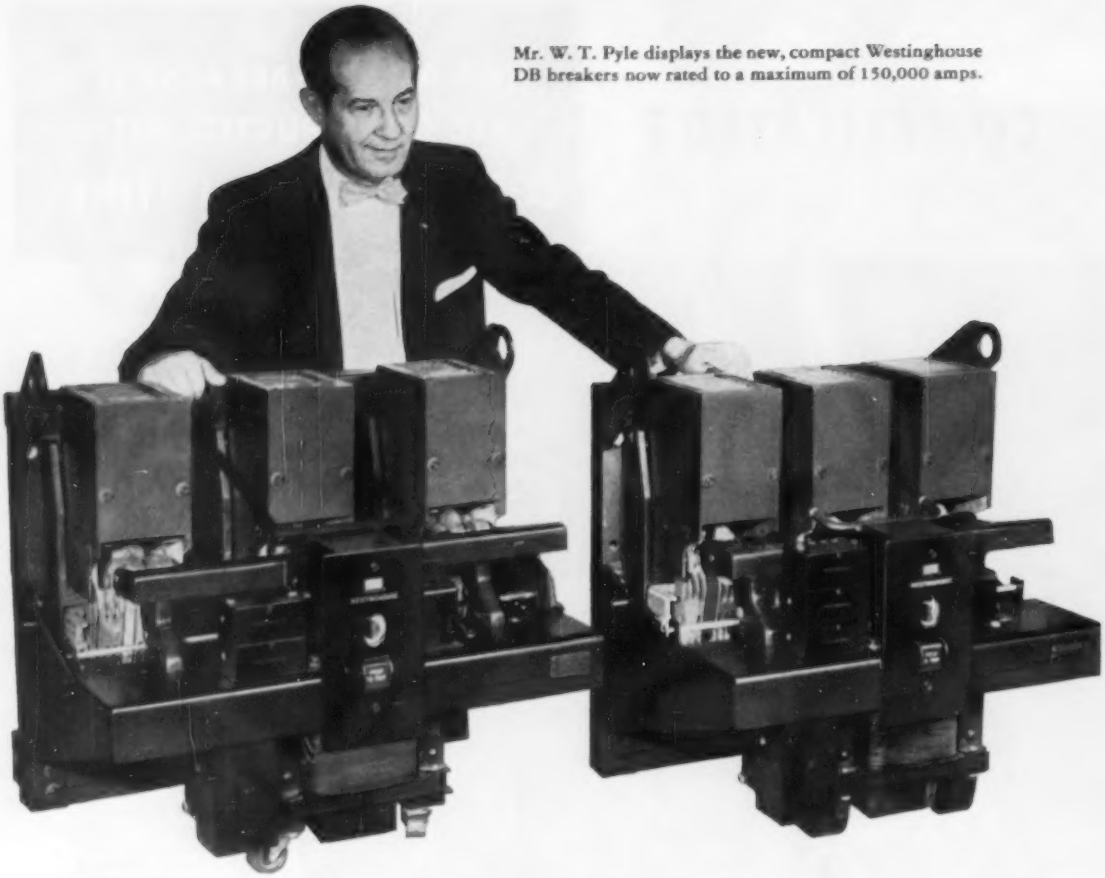
The above photograph clearly illustrates one of the many ways that the new, complete 70,000 Series Cope Cable Trough System and Cope "Rakit" Supports can be rapidly assembled to give perfect support to electrical cables, in Central Stations and Industrial Plants. The wide variety of trough and fittings shown above were speedily joined together to form strong mechanical and electrical joints, without the use of bolts, nuts or washers . . . think of the saving in time and money effected by the use of the "exclusive" Pin-type Cope Couplers.

For further information on Cope Cable Trough, Cable Ladder and Cable Channel Systems, write for Bulletins 67A and 67B.

Cope

T. J. COPE, INC.

711 SOUTH 50th ST., PHILADELPHIA 43, PA.



Mr. W. T. Pyle displays the new, compact Westinghouse DB breakers now rated to a maximum of 150,000 amps.

NEW exclusive functions in L. V. air breakers now up to 150,000 amps interrupting capacity

Three new design developments make Westinghouse L. V. circuit breakers the most versatile, the most useful you can buy.

1. Two new ratings—the DB-75 and DB-100—provide you now with a complete line.
2. Interrupting ratings on all frame sizes have been increased on 240-volt and 480-volt nonselective applications to a maximum of 150,000 amps for the DB-100 at 240-volt.
3. The entire line of DB breakers is equipped with the new air-delayed overload tripping device with a unique range of adjustability, giving you new application opportunities—standard instantaneous and long-time-delay characteristics with a *total of 9 calibrated settings*, or, selective tripping units with numerous combinations of long- and short-time delay, *totaling 13 settings.*

There's more to the story—call your Westinghouse sales engineer, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60885

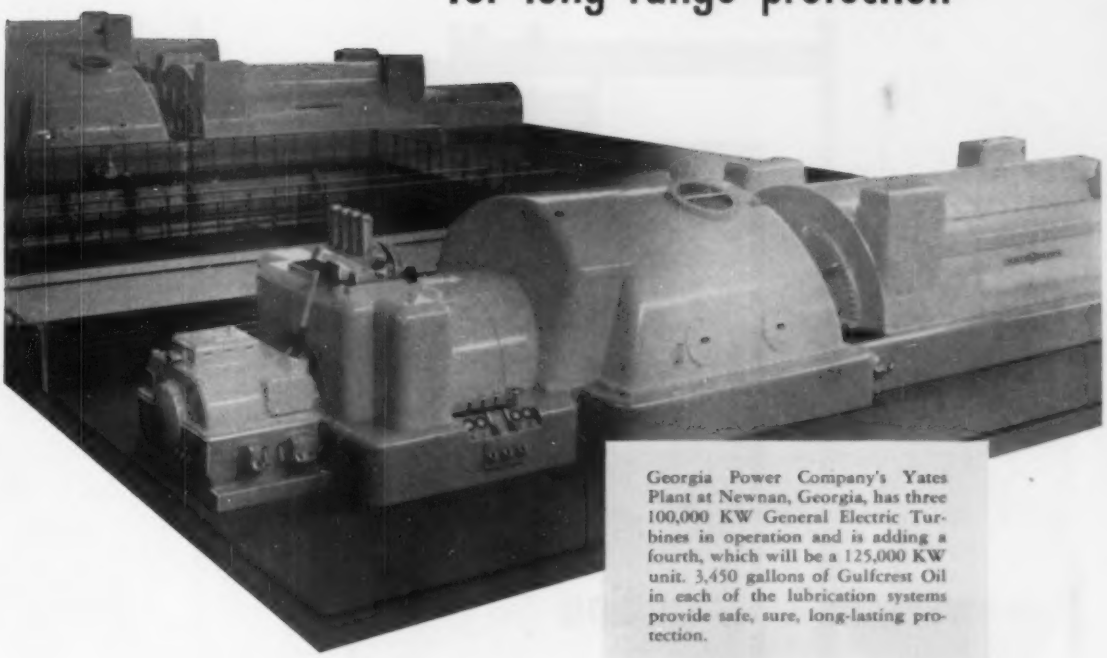
Nonselective Application Ratings for DB Breakers

Frame Size	Old Rating	New Rating 240 volts	New Rating 480 volts
DB-15	15,000A	30,000A	25,000A
DB-25	25,000A	50,000A	35,000A
DB-50	50,000A	75,000A	60,000A
DB-75	75,000A	100,000A	75,000A
DB-100	100,000A	150,000A	100,000A

YOU CAN BE SURE...IF IT'S Westinghouse

Georgia Power Company looks ahead—

selects GULFCREST OIL for long range protection



Georgia Power Company's Yates Plant at Newnan, Georgia, has three 100,000 KW General Electric Turbines in operation and is adding a fourth, which will be a 125,000 KW unit. 3,450 gallons of Gulfcrest Oil in each of the lubrication systems provide safe, sure, long-lasting protection.

Gulfcrest Oil has been in service at the Yates Plant of Georgia Power since 1950. Turbine systems are clean, there is no rust, sludge, or foam. But this is only the beginning. Gulfcrest will provide safe, sure protection for many years to come. (Gulfcrest has been in continuous service in several large turbines for over 20 years.)

There are good reasons for Gulfcrest's recognition as the world's finest turbine oil. Carefully selected crude oils are thoroughly refined, then super-refined by Gulf's exclusive Alchlor Process. This removes the unstable hydrocarbons that accelerate oxidation, form sludge and harmful acids. Then the right additives are properly combined, and you have a turbine oil that delivers superior performance in every type of steam turbo-generator.

A trained, experienced lubrication expert—the Gulf Sales Engineer—is as near as your telephone. Have him recommend the right grade of Gulfcrest for your turbines. Consult the telephone directory for the number of your local Gulf office.

GULF

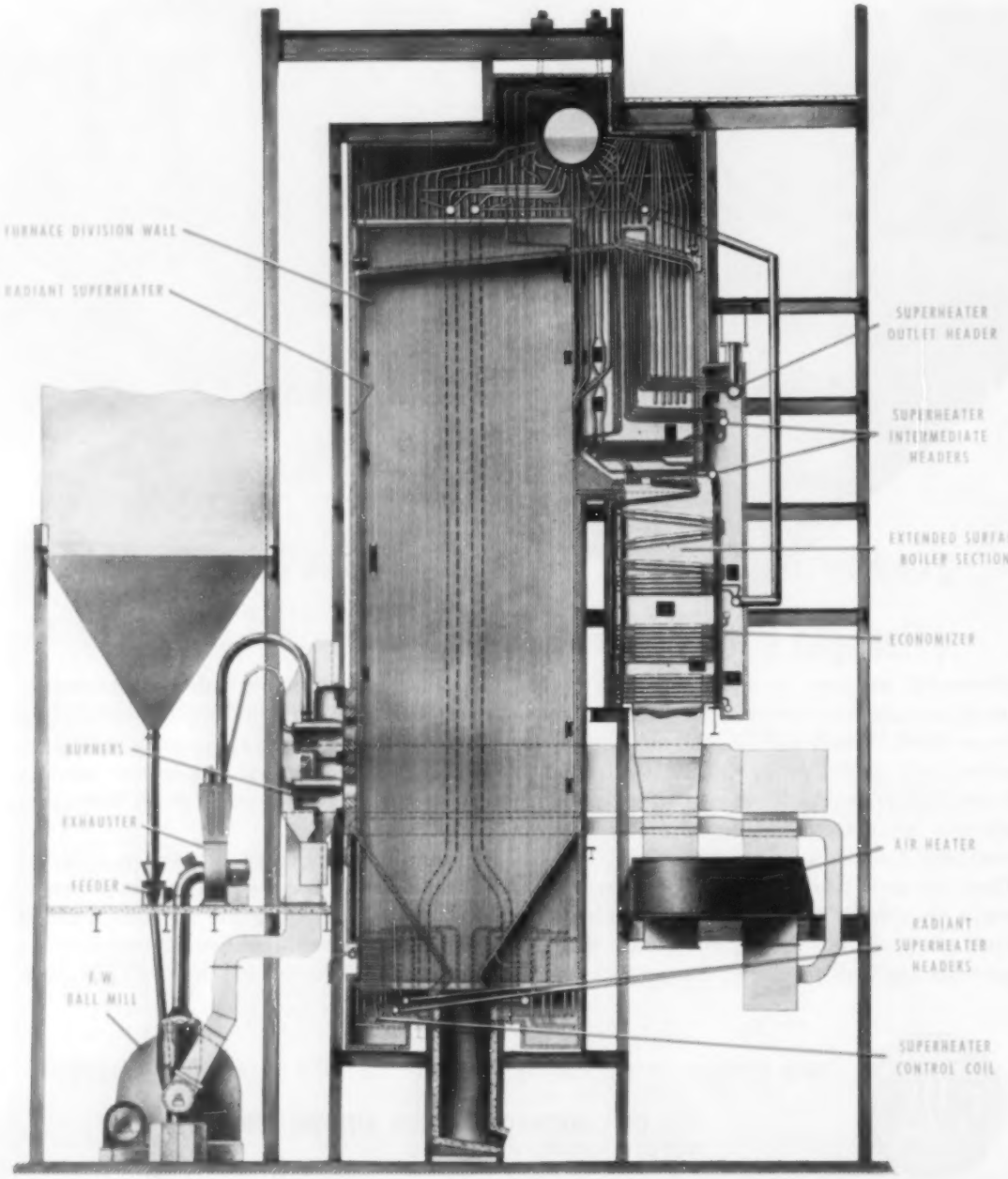
THE FINEST PETROLEUM PRODUCTS FOR ALL YOUR NEEDS

GULF OIL CORPORATION • GULF REFINING COMPANY

1822 GULF BUILDING, PITTSBURGH 30, PA.

large mid-western utility

8th FW STEAM



installs

GENERATOR

New Foster Wheeler Unit supplies 860,000 lb/hr at 1700 psig for 100,000-kw turbo-generator ... brings total capacity on this one system to 2,145,000 pounds per hour!

Latest addition to the modern steam plant shown above is a new 100,000 kw turbo generating unit. It is served by the Foster Wheeler unit shown in section at the left, which generates 860,000 pounds of steam per hour, at 1700 psig pressure and a temperature of 1000 F.

This installation marks the *eighth* large Foster Wheeler steam generator now "on line" in the various stations of this *one* utility system. Among the features of this unit are the FW combination radiant and convection superheaters, new horizontal steam separators, the reliable FW ball mill pulverizer system and the improved intervane burners.

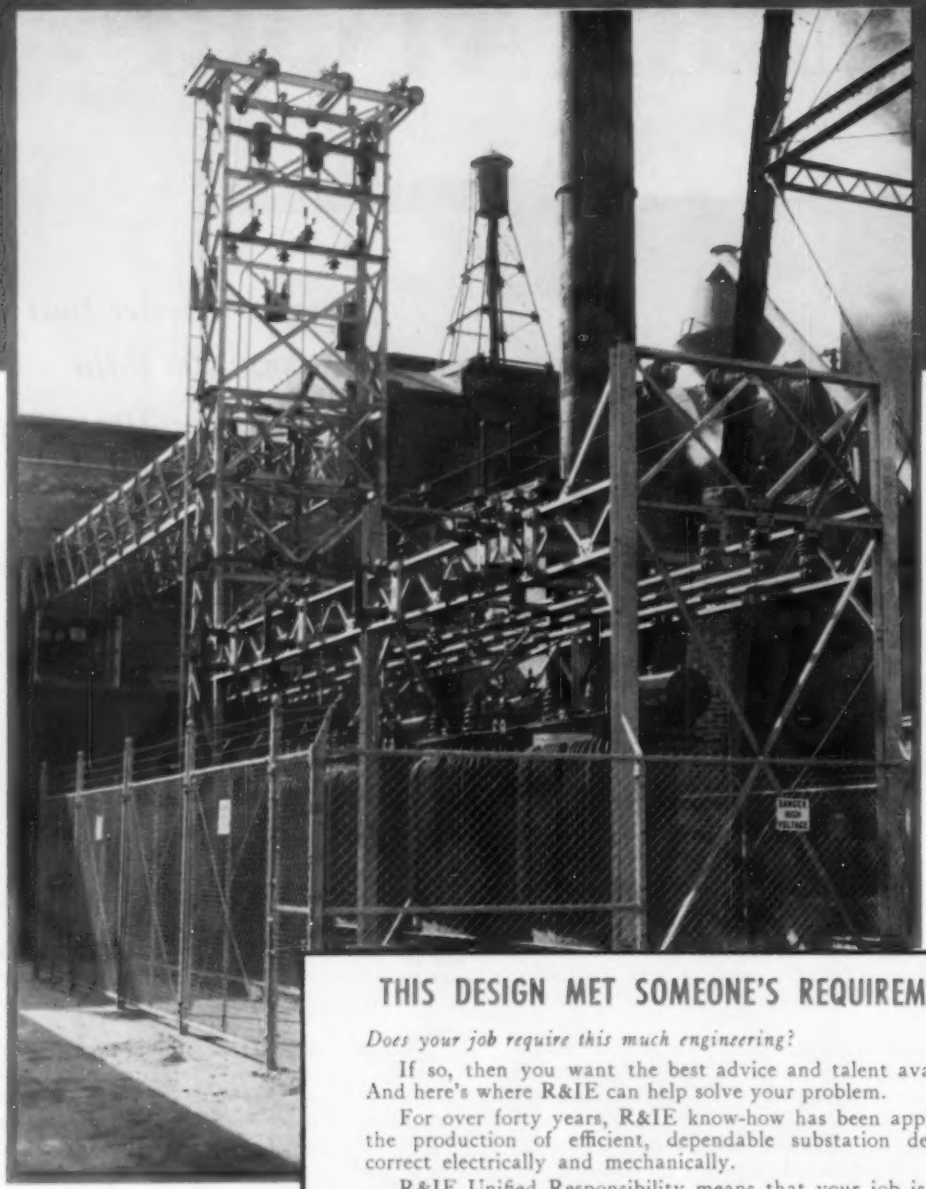
Here we have positive proof of customer satisfaction — based on years of actual on-the-job performance with previously installed FW equipment. That means satisfaction that covers every phase of the job, from planning and erection to successful operation and servicing.

Repeat orders like this, from leading utilities throughout the country, are your best assurance of trouble-free steam generator performance. Whatever your pressure, capacity or steam purity requirements, you can meet them *with confidence* by specifying Foster Wheeler equipment. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER FW WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

Choose the design



THIS DESIGN MET SOMEONE'S REQUIREMENT

Does your job require this much engineering?

If so, then you want the best advice and talent available. And here's where R&IE can help solve your problem.

For over forty years, R&IE know-how has been applied to the production of efficient, dependable substation design—correct electrically and mechanically.

R&IE Unified Responsibility means that your job is easier to order, to check, to change, and to erect. All factors necessary to coordinate and produce a substation structure are controlled "under one roof".

If your requirements do not involve such problems as special arrangements, property restrictions, special circuit requirements, then you can base your planning on a standard structure.

to fit your problem . . .

on your next

OUTDOOR INDUSTRIAL SUBSTATION

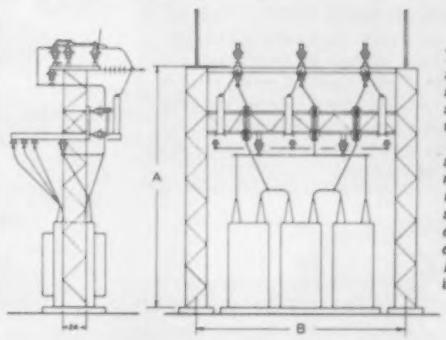
Is it SIMPLE or COMPLEX?
R&IE Offers the Solution for Each

The STANDARD Solution provides -

1. **Simplified Ordering:** — Miscellaneous items involved can be minimized, sometimes eliminated from the usual listing of material.
2. **Quick Delivery:** — Engineering time is considerably reduced. Parts and assemblies are standardized so orders can be filled and shipped rapidly.
3. **Simple Erection:** — All parts are shipped as one package and major components can be pre-assembled, when desired.
4. **Lower Cost:** — Savings in engineering, production, shipping, and erection time, add up to lower cost for your substation.

The CUSTOM Solution provides -

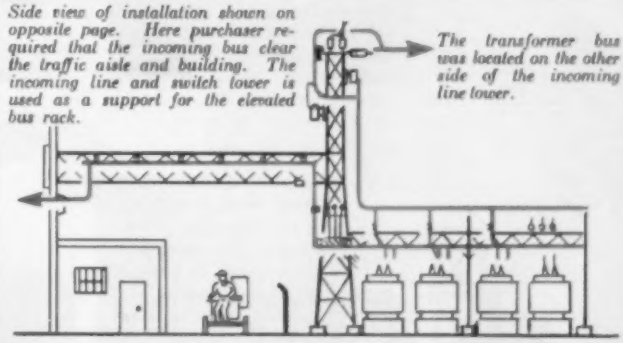
1. **Unusual Arrangements:** — Station can be designed to accommodate the most complex or unusual circuit arrangement.
2. **Special Structures:** — Special right-of-way, real estate, and obstruction problems can be solved by a correctly designed custom substation.
3. **Fulfilling Exact Requirements:** — Your preferences for equipment are followed precisely. Long experience in fabricating assures correctness of detail.
4. **Speedy Engineering:** — Experienced engineers and detailers work fast and accurately. Fine workmanship means no mistakes and no delays in submitting plans for approval.



Two views of a Type A standard substation designed to provide simple step-down service at voltages from 7.5 to 69 Kv. This kind of a station will adequately meet the needs of many industrial users. Five standard plans, each capable of expansion, are detailed in the New R&IE Substation Manual.

Side view of installation shown on opposite page. Here purchaser required that the incoming bus clear the traffic aisle and building. The incoming line and switch tower is used as a support for the elevated bus rack.

The transformer bus was located on the other side of the incoming line tower.

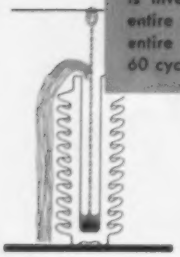


R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER COMPANY
GREENSBURG, PA.

STRUCTURES—steel or aluminum ● TESTING DEVICES ● KIRK KEY INTERLOCK SYSTEMS ● ISOLATED PHASE BUS STRUCTURES ● INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION ● OUTDOOR BUS SUPPORTS and AIR SWITCHES ● SUBSTATION

100% ELECTRICAL TESTING • Soundness of head (where such a ceramic piece is most likely to be cracked) is assured by flashover test of every piece. Before plugging or assembly, porcelain body is inverted, a chain dropped the entire depth of the hole, and the entire unit subjected to a 3-minute 60 cycle flashover.

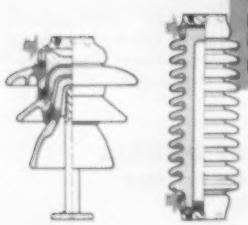


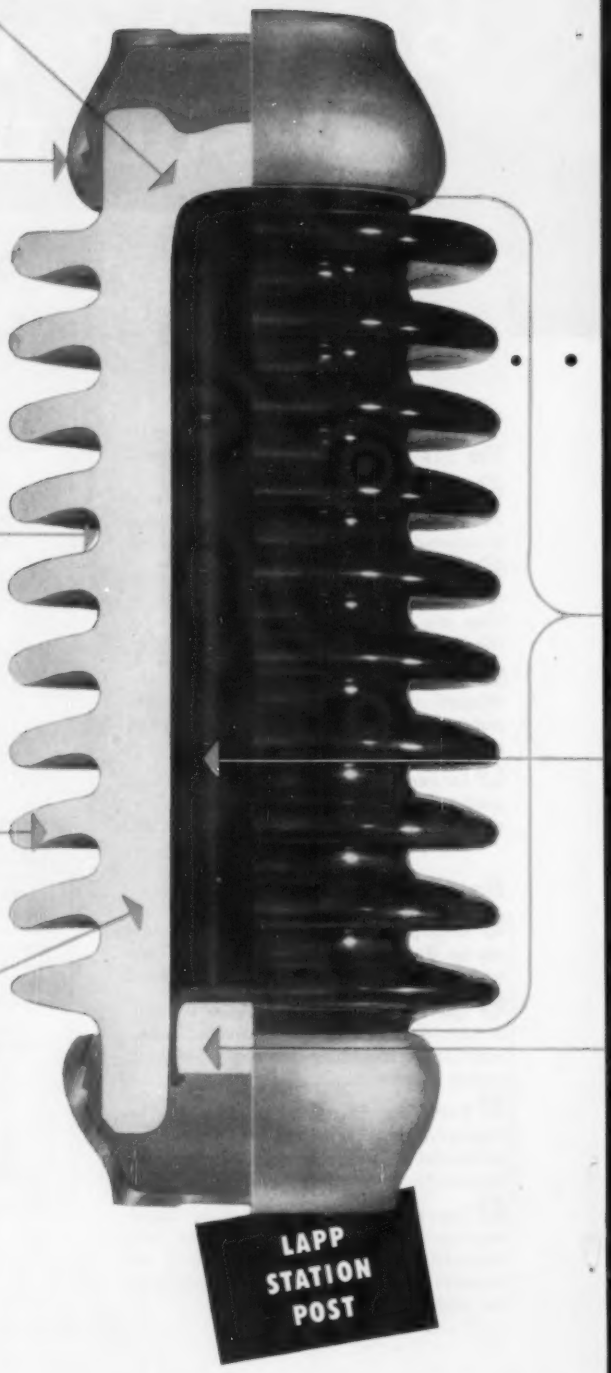
HARDWARE EXTERNALLY ATTACHED • Bases and caps are cemented *ON*. Porcelain is loaded only in large-area low-intensity compression grip; this eliminates the cause of insulator cracking.

UNIFORM LEAKAGE PATH • Leakage distance secured through multiple short petticoats—*Lapp fog-type design*. Flanges are spaced for natural cleaning action of wind and rain—avoid concentrated hot-spots where local stress can precipitate flashover. This is also the ideal surface for horizontal mounting of insulators.

SHORT STURDY PETTICOATS • Protect body from impact or flashover. Will withstand much more severe attack than required to crack shell-type units, yet will finally break off clean and leave body undamaged.

RIGID UNDER DEFLECTION • One piece porcelain body. No nested porcelain parts, no internal pins, studs or inserts—no internal forces to load porcelain in tension.





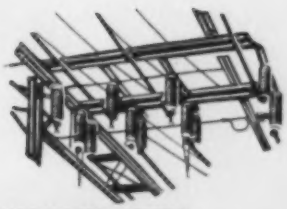
The service record on switch and bus insulators on any major system will show the superiority of Lapp Station Post insulators. Since 1931, these units have been handling dirt conditions, lightning flashover, mechanical shock and loading—with fewer outages, and at lower maintenance and replacement cost, than any other type of station insulator. One reason, of course, is the basic superiority of the design—the Lapp conception of giving mechanical as well as electrical responsibility to a column of porcelain. The other reason is that *Lapp knows how to make 'em*—how to take advantage of the special strengths of porcelain and avoid its weaknesses. The result is the Lapp Station Post; it will improve service and save money on *your* system. Lapp Insulator Co., Inc., Le Roy, New York.

. . . . THE INSIDE STORY

of Station Post reliability

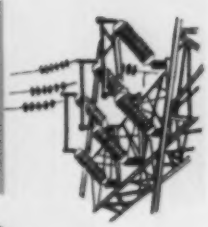
"STRAIGHT-LINE" FLASHOVER • Live terminals are separated by full length of insulator; flashover goes *outside* the unit. Loss of one or more petticoats does not reduce flashover distance.

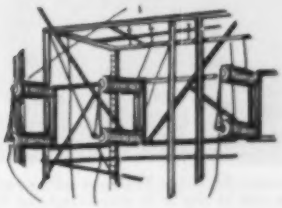
INSIDE GLAZED • All Lapp Post porcelains are glazed inside and outside—a Lapp extra-quality feature that makes for added cleanliness and more critical visual inspection.



PERMANENTLY PLUGGED PORCELAIN • *After thorough electrical testing*, porcelain body is plugged with porcelain and natural rubber—a Lapp design that has stood the service test of 20 years. This assures a permanently clean, dry hole; avoids internal conductive contamination.

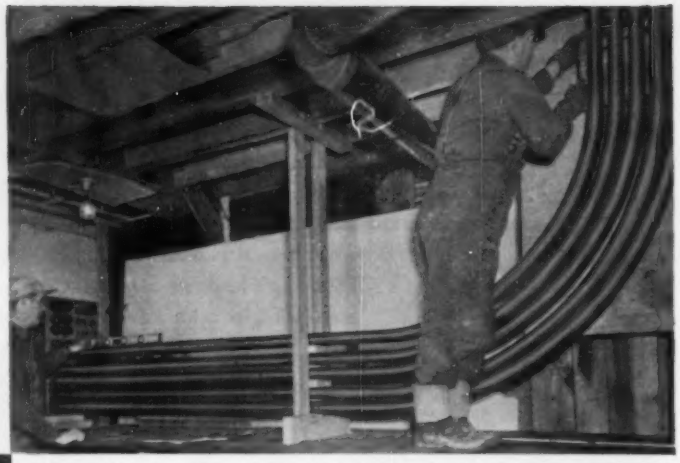
SAME STRENGTH INVERTED • Mount 'em upright, obliquely, horizontally, or inverted—mechanical and electrical characteristics give a safe margin of operating security.





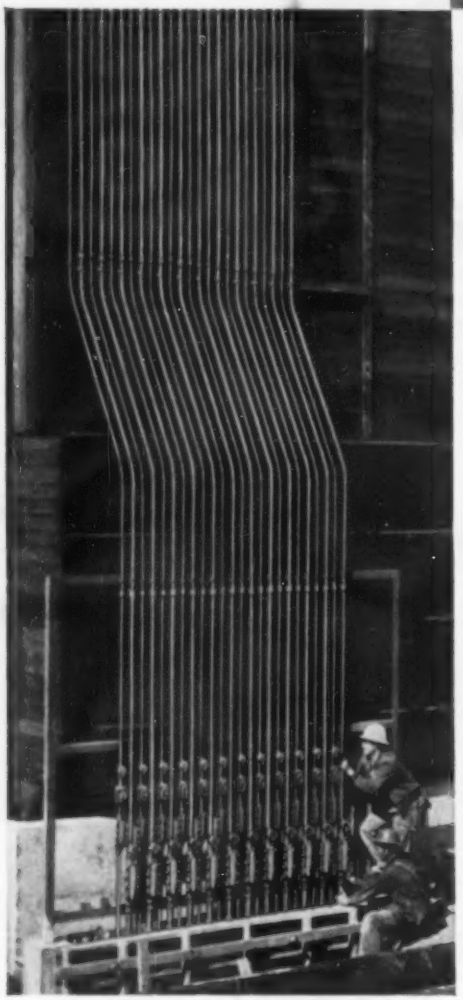
Lapp

DOWN a humid 180 feet below water level at Downsville Dam



Some 3600 feet of 2" Everdur Conduit (E.M.T.) protect electric lines in a service shaft plunging down to the release water chamber 180 feet below water level at Downsville Dam of the New York Metropolitan Water Supply System. Electric lines operate vital valves, indicating and communication equipment.

UP in the corrosive air at a water cooling tower



During the War, General Petroleum Corp. saw galvanized conduit fail within a year at one of its plants—replaced it with Everdur Conduit. At its new Ferndale Mobilgas Refinery in Washington, some 12,000 pounds of Everdur Conduit in various sizes guard electric power lines for motors and lighting in this water cooling tower.

EVERDUR Conduit will guard the electric power lines—for years

Everdur* Never Rusts. It offers high resistance to other types of corrosion. That's why Everdur Conduit—made from one of Anaconda's exclusive copper-silicon alloys—is specified for dependable year-after-year protection of electric power lines in industry, on bridges, at power and water supply projects—wherever water and corrosive atmospheres are a problem—or where conduit must be buried or embedded in concrete.

Everdur is Tough. In addition to corrosion resistance, Everdur has high physical strength, resists wear and abrasion. It stands up under movement and vibration, as on a bridge, in a subway, in a factory.

Everdur is Nonmagnetic. Everdur Conduit creates no magnetic field to produce temperature rise in electric power cables.

Everdur Electrical Conduit is available in two wall thicknesses —R.C. in nominal sizes from ¼" to 4", inclusive, and E.M.T. in nominal sizes ⅜" to 2", inclusive. For more detailed information write: The American Brass Company, Buffalo Division, Buffalo 5, N. Y. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 55120

*Reg. U. S. Pat. Off.

EVERDUR ELECTRICAL CONDUIT

ANACONDA®

COPPER SILICON ALLOYS

CORROSION RESISTANT • STRONG • NONMAGNETIC • WORKABLE • WELDABLE

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You may find your answer here, because **Testing for Industry** has been our business for nearly 60 years. We have excellent equipment and competent, thorough, experienced men who know how to use it.

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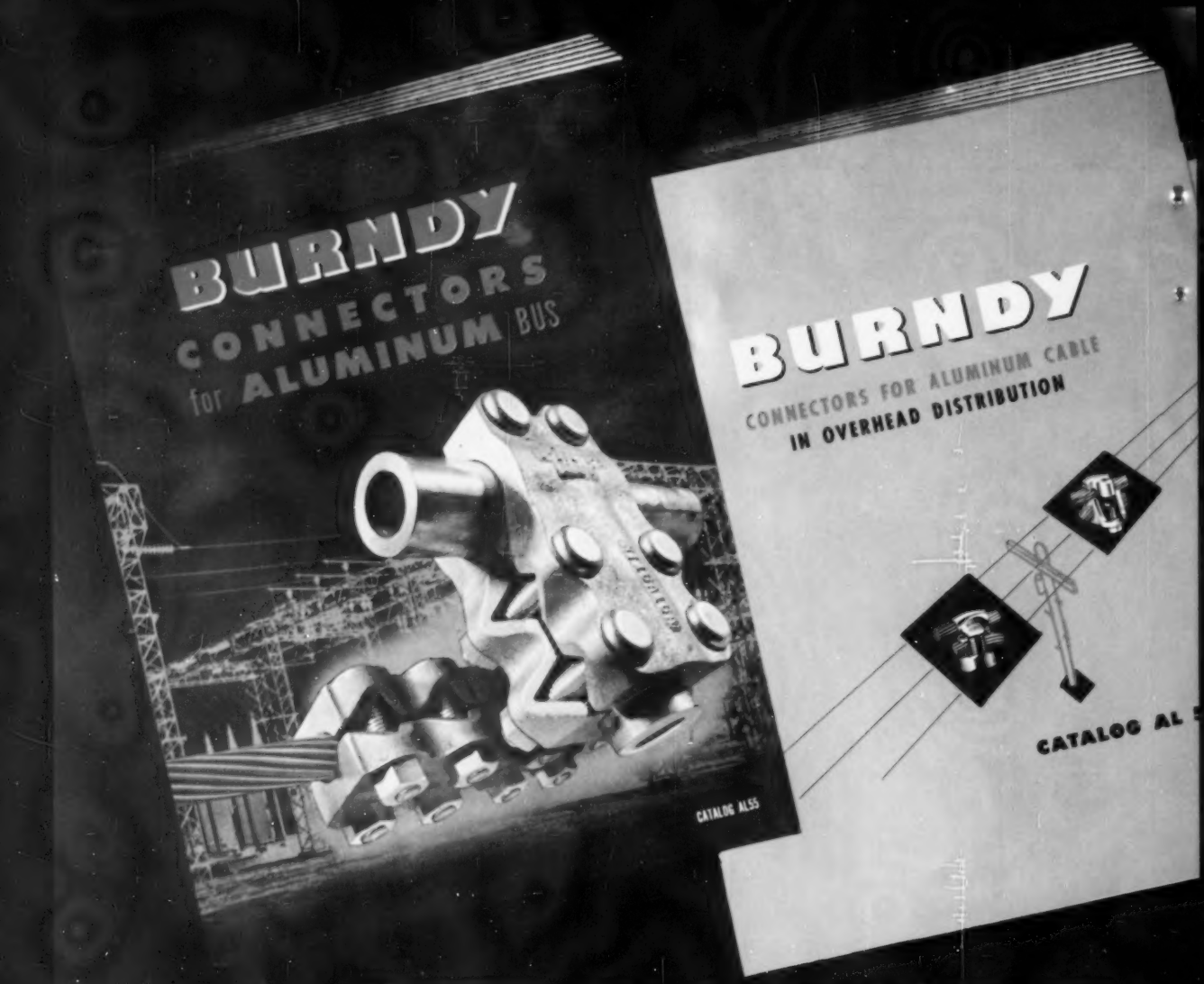
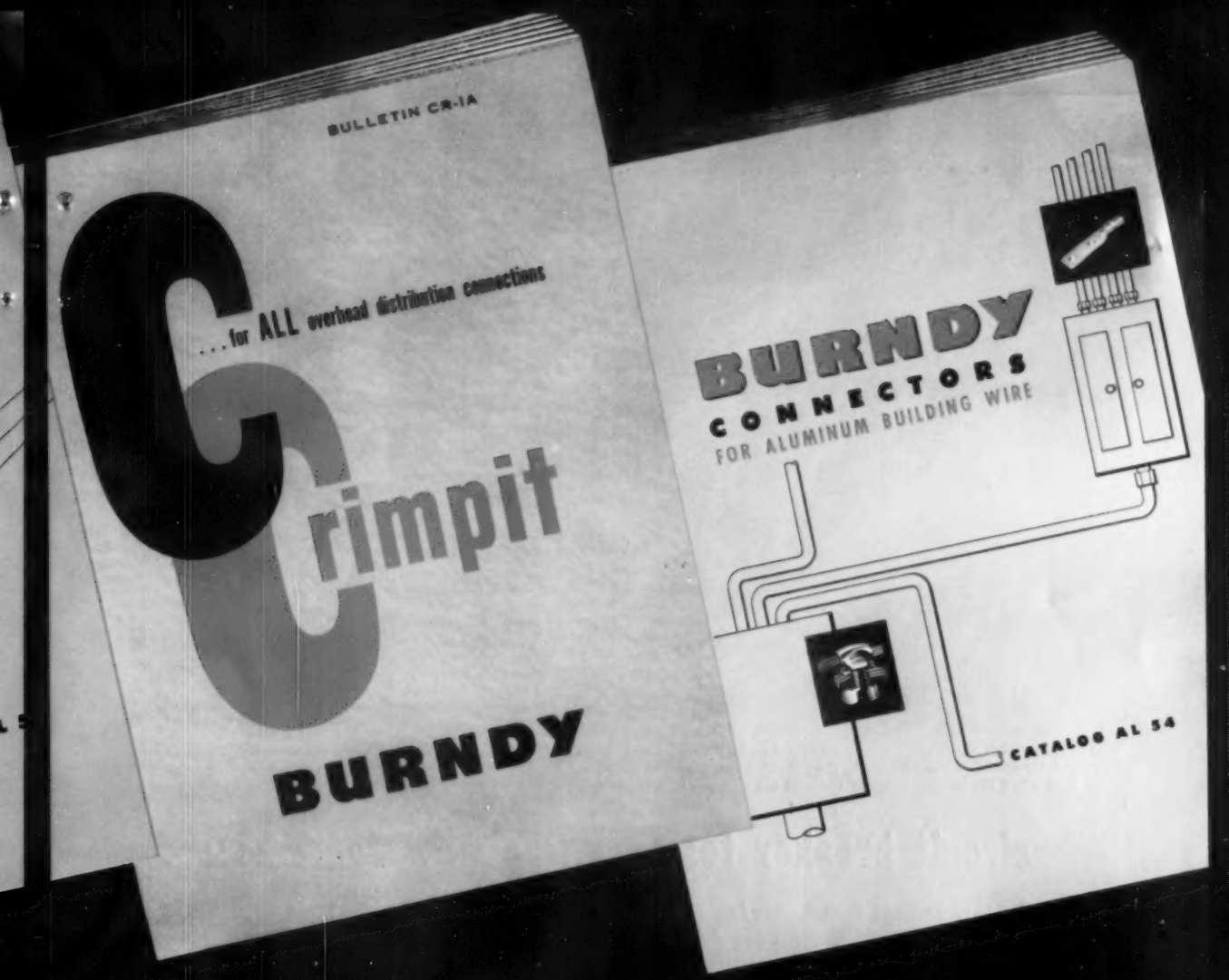


if you are considering

ALUM

Yours . . . FREE for the asking—a veritable "library" on electrical connectors for aluminum. This compilation of technical details and methods is made possible by Burndy's years of intensive design and manufacturing in this important field. Whatever your current or contemplated project—substation, transmission, or distribution—these catalogs can help you select the methods as well as the connectors best suited to the job.



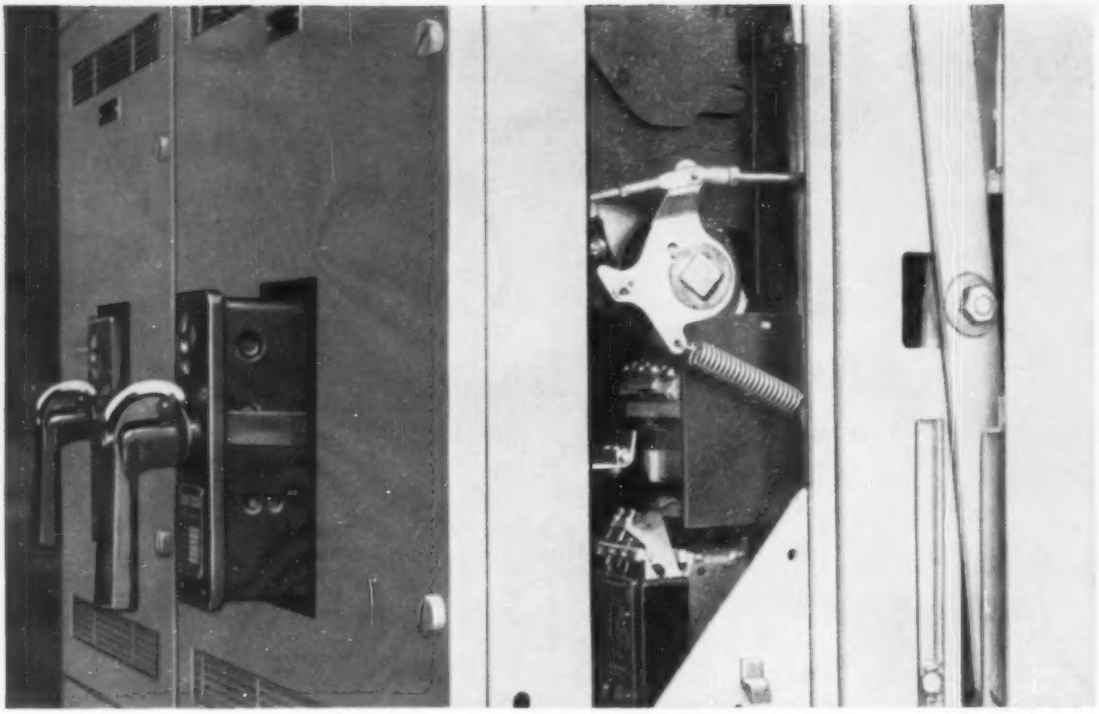
INUM

here are your connectors

BURNDY

55-27

Norwalk, Conn. · Toronto, Canada · Other factories: New York, Calif., Toronto · Export: Philips Export Corp.



Test position with doors closed now standard on I-T-E low voltage switchgear. This exclusive I-T-E feature is made possible by an extendable escutcheon which permits the operating handle and visual indicator of the breaker to extend through the closed compartment door when the breaker primary contacts are disconnected. Special cutout in side sheet shows breaker within compartment.

NOW—circuit breaker test position with doors closed

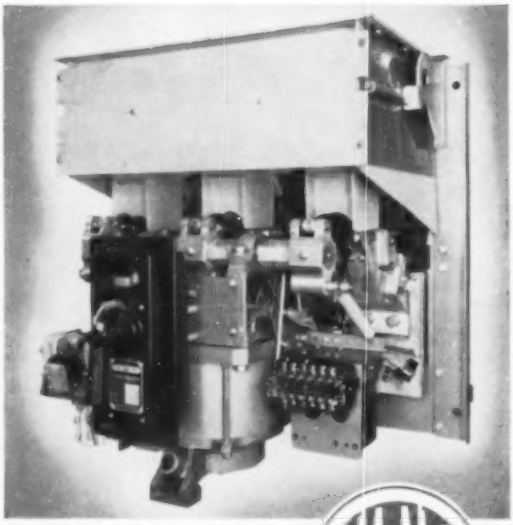
Exclusive I-T-E low voltage switchgear feature increases safety, reduces handling, provides better dust protection, permits easier circuit identification

Consider the many advantages of testing circuit breakers with compartment doors closed or of leaving de-energized breakers in their individual compartments protected against dirt and damage during installation and shutdown. Consider, too, the simplification of maintenance, inspection and "tagging out" of circuits during normal operation. They are all yours in the modern, compact design of the new standard I-T-E Low Voltage Switchgear—at no increase in cost.

New compact KD and KE circuit breaker design saves space

With the addition of the new KD and KE breakers, the line of K type breakers is complete through 4000 amp continuous, 100,000/150,000 amp interrupting @ 600/240 v a-c. Considerably smaller than their predecessors, Types KD and KE circuit breakers fit into three-high and two-high compartments respectively. This saves space, permits instrumentation in the same frame. In addition, the broadening of breaker interrupting ratings—now approved by NEMA—reduces switchgear costs by permitting the application of smaller size circuit breakers for short circuit protection on 240 v a-c and 480 v a-c systems.

For complete information, contact your nearest I-T-E sales office. Or write for Bulletin 6004B. I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Phila. 30, Pa.

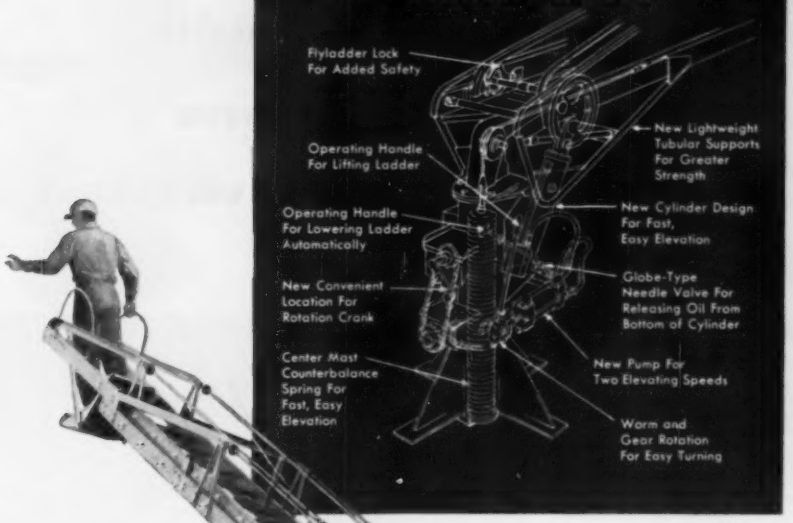


New Type KD circuit breaker typifies the latest design which extends the range of ratings of the I-T-E Type K family of breakers.

I-T-E

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

NEW 2500 SERIES MANUALLY-OPERATED HYDRAULIC LADDER


Flyladder Lock For Added Safety
Operating Handle For Lifting Ladder
Operating Handle For Lowering Ladder Automatically
New Convenient Location For Rotation Crank
Center Mast Counterbalance Spring For Fast, Easy Elevation
New Lightweight Tubular Supports For Greater Strength
New Cylinder Design For Fast, Easy Elevation
Globe-Type Needle Valve For Releasing Oil From Bottom of Cylinder
New Pump For Two Elevating Speeds
Worm and Gear Rotation For Easy Turning

NEW WAY TO GET UP IN THE WORLD

The Holan 2500 Manually-operated Hydraulic Ladder does things no other mechanical ladder can do. With a low-pressure hydraulic system and center mast counterbalancing, the 2500 raises and lowers fast and easy—in a matter of seconds. Elevating locations are infinite; and the angle of elevation can be changed with ladder fully extended . . . safely and without effort.

Other new features of this newest Holan work-simplifier include tubular ladder supports for lighter weight and greater strength; rotation crank located at rear for easier turning, better view and maximum clearance between ladder and body side; and an optional duo-level platform that assures level footing even at lowest angles.

Write for information about the latest addition to industry's biggest and most versatile aerial ladder family.

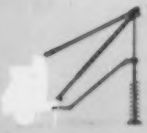
Holan 2500 Manually-operated Hydraulic Ladder with new duo-level platform. Available for 24′, 28′ and 32′ platform-to-ground heights.

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Service bodies for chassis up to 1½ ton. Lengths, 72″, 78″, 84″, 90″, and 102″.

Power derricks designed for front or rear mounting. Capacities to 12,000 lbs. Handle poles to 75 feet.

Ladders to 40′ with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter. Also, expertly-engineered mechanical ladders to 32′.



Portable hydraulic and mechanical earth borers. Augers for 8″ to 20″ diameters, depth to 8′.

Hydraulic towers from 17′ to 30′ with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

J.H. HOLAN CORPORATION

4100 WEST 150TH STREET
CLEVELAND 11, OHIO

OTHER PLANTS:
HOLAN Thrift Line CORP., Griffin, Georgia • J. H. HOLAN CORP., Phoenix Div., Arizona
BRANTFORD-HOLAN LIMITED, Brantford, Ontario

THE NAME THAT MEANS WORK SIMPLIFICATION

Designed and built to specifications you might have written...

Power Capacitor Specifications
1. Corrosion protection – even though case finish is scratched.
2. Solder-sealed porcelain bushings.
3. Reliable performance at low ambient temperature.
4. Suitable for vertical or horizontal mounting.
5. Low losses.
6. Low temperature rise.
7. Stability under all operating conditions.
8. Terminal connectors for either copper or aluminum.

SANGAMO POWER CAPACITORS

Perhaps *you* were one of the many utility men Sangamo engineers talked to before starting to build "the power engineer's capacitor." In these talks we found out you wanted not only a capacitor that will release system capacity, raise system voltage and reduce system losses – but one that will do these things under all operating conditions.

The reason for the Sangamo Capacitor's reliable operation in low surrounding temperatures is Sangamo Diaclor, the high-strength, low-loss liquid dielectric which completely fills the capacitor. This characteristic permits switching of capacitor banks even after long periods of de-energization at low ambient temperatures.

So no matter what winter brings–snow, ice, freezing rain–even 40 degrees below zero, Diaclor enables Sangamo Capacitors to go right on doing their jobs just as though it were a mild spring day.

For more details, write today for Bulletin 1120.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

PCS9-5

Rugged construction of high pressure rear contact.

NEW 3E SIDE BREAK SWITCH

THE BF-20

A completely new switch, with many advanced features that make it the best buy in low cost, outdoor switchgear . . . and its long life is assured by sound design, a minimum of parts, and extra heavy construction. Typical of the quality products that have established Three-E's reputation.

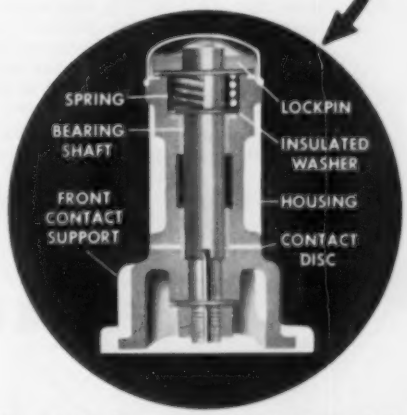
When you need a side break switch,

CHECK FOR THESE MODERN FEATURES

1. **Simple, rugged design.**
2. **High pressure silver contacts, braidless for longer life.**
3. **Toggle motion, positive ice breaking and wiping action.**
4. **The switch can be assembled for right or left hand operation, with the same components.**

Available through 161 KV, 600 Amp and 1200 Amp.

Front contact in open position.



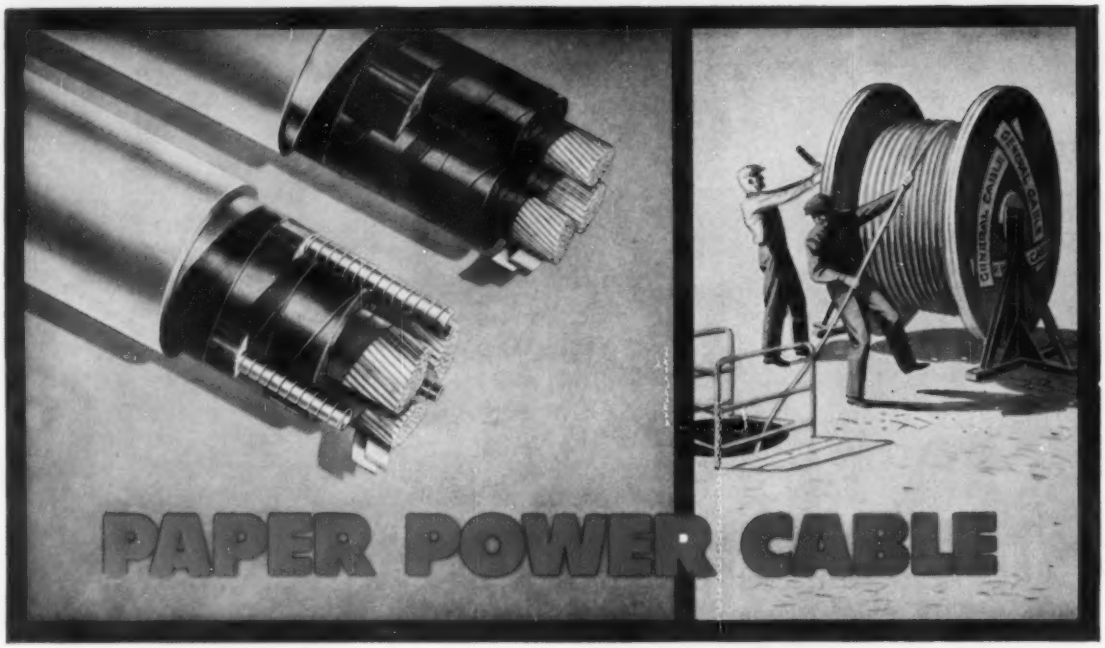
The current travels through the front contact bearing unit, which rotates to give the toggle action, and is transferred to the support at the silver contact disc. An insulated low stressed, stainless steel coil spring keeps the two parts under high pressure contact at all times.

Write for new bulletin 335.

3E — THREE E

ELECTRICAL ENGINEERS EQUIPMENT CO., MELROSE PARK, ILLINOIS

THE GREATEST NAME IN ELECTRICAL WIRE AND CABLE



Pioneers in the development of Paper Power Cables, General Cable Engineering leadership and manufacturing skill is combined to provide a *uniformly high quality product.* Conductors are made to finest possible tolerances, insulations are thoroughly tested and inspected before and after assembly — in fact, *every* step of manufacture is under the most rigid quality control.

The biggest producer, General Cable also makes the widest range of types. For example: solid, low pressure gas-filled, low pressure oil-filled, high pressure oil-filled (pipe type), high pressure gas-filled (pipe-type), and high pressure oil or gas-filled (self-contained).

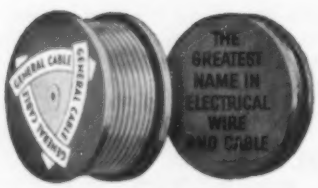
Available in widest range of conductors: Compack Round, Concentric, Compack Sector, Annular Concentric, Compack Segmental, Hollow Core.

Made in largest variety of finishes: Jute, Duck Tape, Reinforced Neoprene, Synthetic Plastics, Flat Steel Tape or Steel Wire Armor.

The forementioned represent but a few of the wide range of types manufactured by General Cable... plus other types made to customer specifications.

Next time you're talking Paper Power Cable . . . or any type of electrical wire and cable, call in your friendly General Cable Representative... there's one near you.

GENERAL CABLE
CORPORATION



BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

GENERAL CABLE CORPORATION
Executive Offices: 420 Lexington Ave., New York 17, N. Y.

SALES OFFICES: Atlanta • Baltimore • Boston • Buffalo Chicago • Cincinnati • Cleveland • Dallas • Dayton • Denver Detroit • Erie (Pa.) • Greensboro (N. C.) • Houston Indianapolis • Kansas City • Lincoln (Neb.) • Los Angeles Memphis • Milwaukee • Minneapolis • New Haven • New Orleans • Newark (N. J.) • New York • Philadelphia Pittsburgh • Portland (Ore.) • Richmond (Va.) • Rochester (N. Y.) • Rome (N. Y.) • St. Louis • San Francisco Seattle • Springfield (Ill.) • Syracuse • Tampa • Tulsa Washington (D. C.)

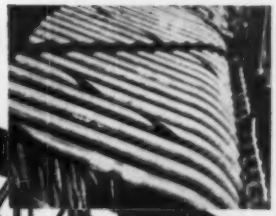
THEY'RE FROM MISSOURI

When Missouri Public Service Company needed a power plant constructed, they compared the performance records and experience of the companies bidding for the job.

They had to be shown; they chose Pritchard.

From the very first day, they started appreciating the close cooperation all the way down the line between Pritchard's staff and their own. This mutual respect and understanding made it possible for the job to get done right.

Pritchard has the ability and experience to handle the complexities of design, engineering and construction of your power plant. Let Pritchard show *you* the way to a profitable installation.



Boiler Water Tubing

INDUSTRY'S PARTNER FOR PROGRESS

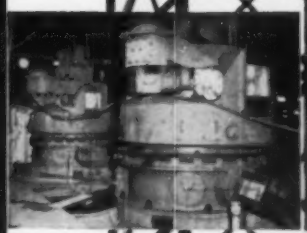
SERVING THE GAS, POWER, PETROLEUM AND CHEMICAL INDUSTRIES

BOSTON, BUFFALO CHICAGO, HOUSTON NEW YORK PITTSBURGH ST. LOUIS TULSA

J.F. Pritchard & Co.

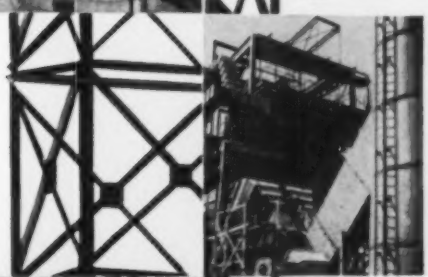
ENGINEERS • CONSTRUCTORS

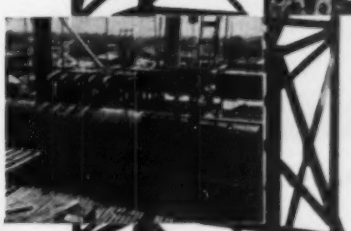
Dept. 452, 4625 Roanoke Parkway, Kansas City 12, Mo.



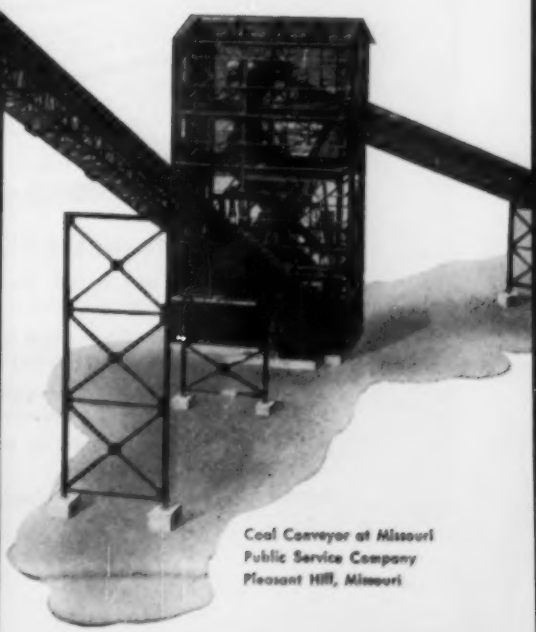
Coal Pulverizers

Induced Draft Fan





Exterior View of Boiler

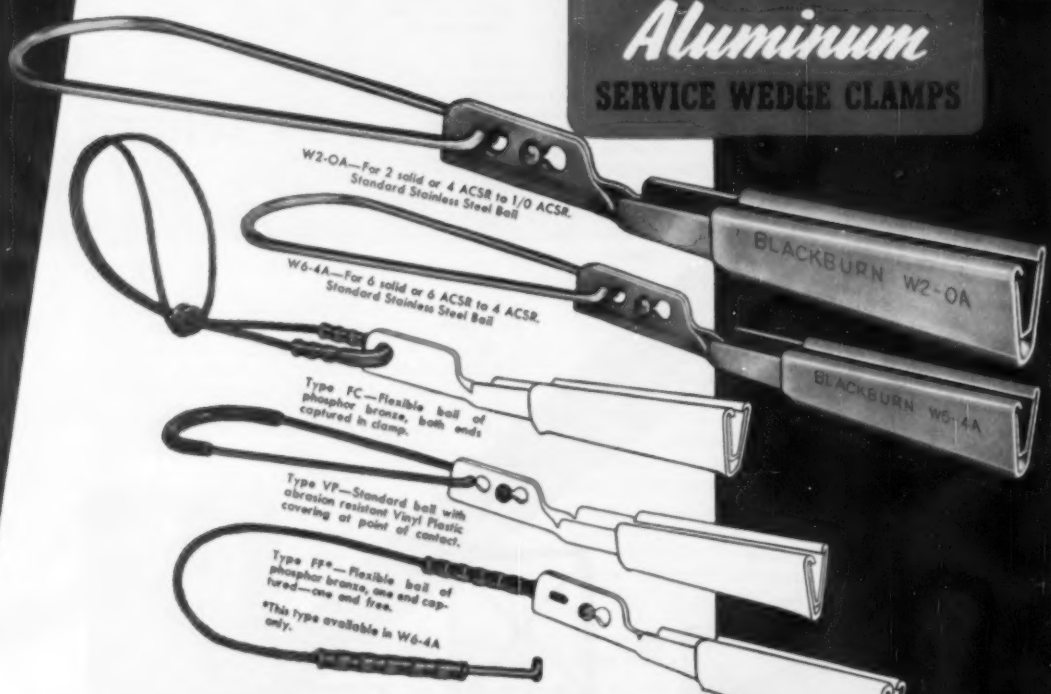


Coal Conveyor at Missouri Public Service Company Pleasant Hill, Missouri

NOW!

YOUR CHOICE OF 2 SIZES in...

BLACKBURN *Aluminum* SERVICE WEDGE CLAMPS


W2-OA—For 2 solid or 4 ACSR to 1/0 ACSR. Standard Stainless Steel Bail
W6-4A—For 6 solid or 6 ACSR to 4 ACSR. Standard Stainless Steel Bail
Type FC—Flexible bail of phosphor bronze, both ends captured in clamp.
Type VP—Standard bail with abrasion resistant Vinyl Plastic covering at point of contact.
Type FF*—Flexible bail of phosphor bronze, one end captured—one end free.
*This type available in W6-4A only.
BLACKBURN W2-OA
BLACKBURN W6-4A

ALL BLACKBURN WEDGE CLAMPS HAVE FULL GRIPPING SURFACE

—Conductor is in contact with the wedge for the entire length of the slider and, *they are easily installed.*

- **Removable aluminum slider allows clamp to be installed without threading through clamp.**
- **Drop wire can be pre-sagged and cut to exact length—saves conductor—saves time.**
- **Clamp can be attached to bare neutral at any point in the span.**

Available through electrical wholesalers everywhere.

JASPER BLACKBURN CORPORATION

35 MADISON STREET
ST. LOUIS 6, MISSOURI
PHONE MAIN 1-2821

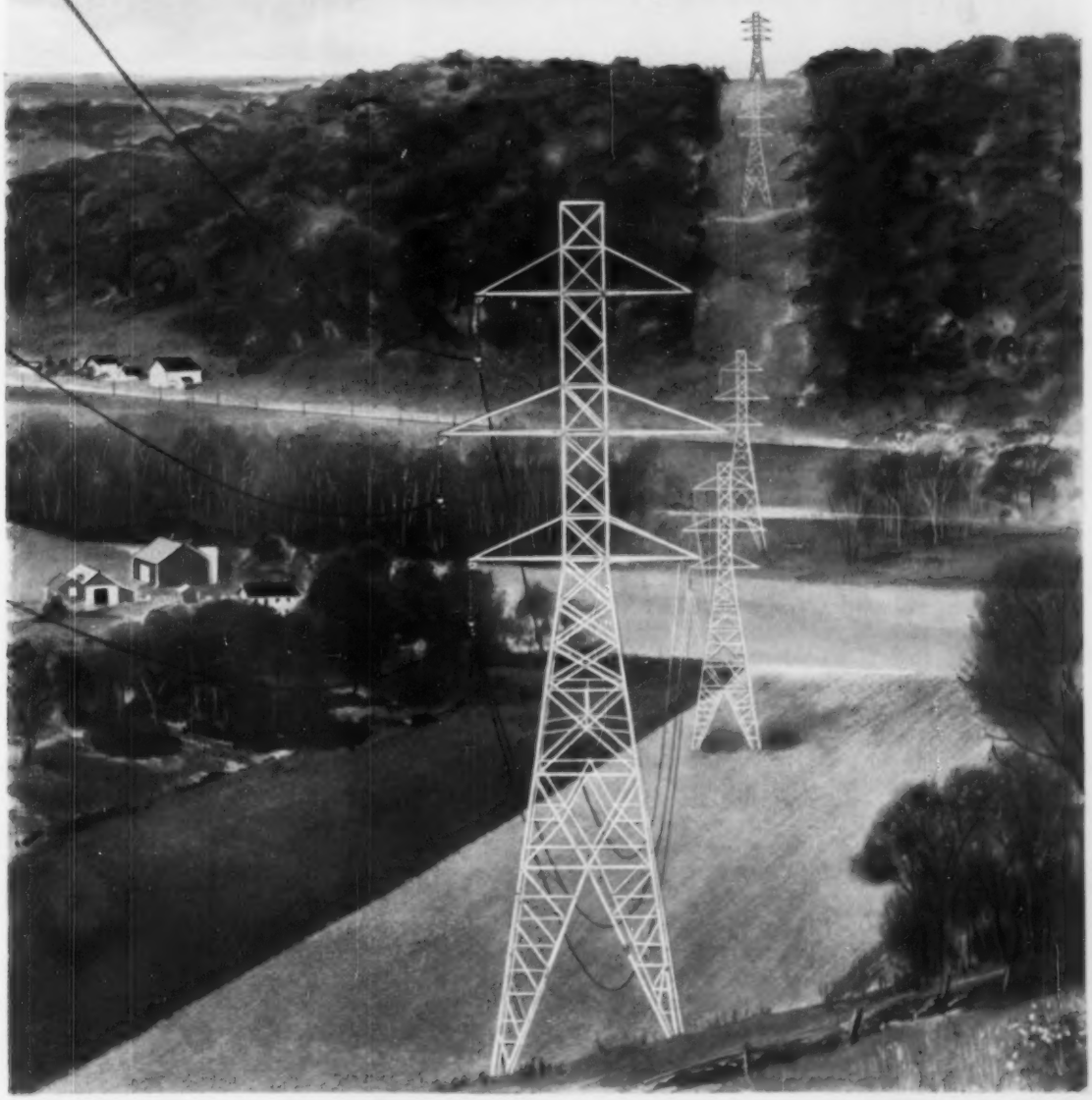
330,000 VOLTS
REQUIRE SPECIAL SKILL

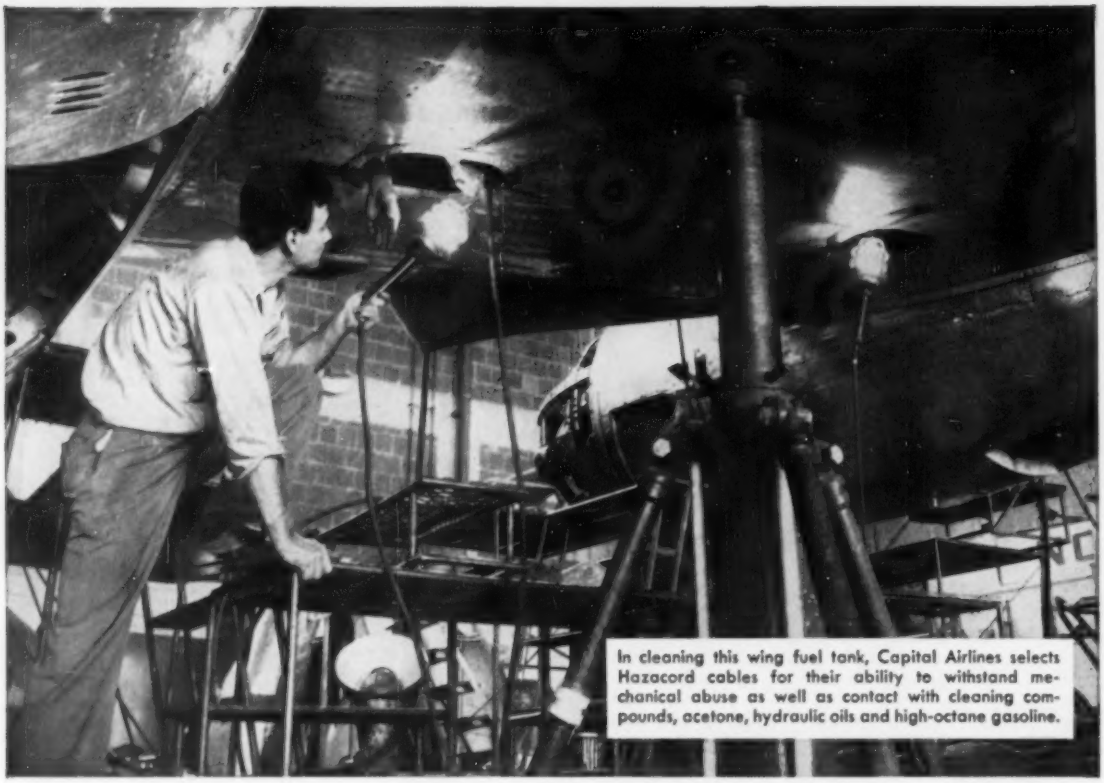
This transmission line in Indiana and one like it in West Virginia are among the few lines in the United States carrying this unusually high voltage. Both were built by Hoosier. For Thirty-five years Hoosier engineers have provided the special skill that results in efficient and economical erection of transmission lines.

ERECTION AND MAINTENANCE OF TRANSMISSION LINES

1384 HOLLY AVENUE • COLUMBUS 8, OHIO

HOOSIER ENGINEERING CO.





In cleaning this wing fuel tank, Capital Airlines selects Hazacord cables for their ability to withstand mechanical abuse as well as contact with cleaning compounds, acetone, hydraulic oils and high-octane gasoline.

where high octane fumes require maximum safety, airline maintenance shop demands Hazacord cables

In 1952, Capital Airlines installed heavy duty Hazacord cables on all their portable tools and explosion-proof trouble lamps. The change was made only after Capital officials had investigated cords supplied by many leading manufacturers and were fully convinced that Hazacord provided the safest possible service where high octane fuel and vapors were present.

Today, the company still uses Hazacord exclusively for this type of work. According to Capital's Safety Director, C. F. Schaub, here's why:

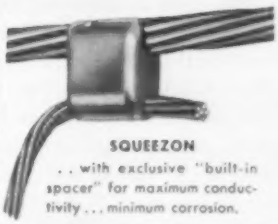
"The cords used in aircraft maintenance work get rough handling and frequently come in contact with chemicals, such as cleaning compounds, paint thinner, acetone and hydraulic oils, that weaken cord sheaths badly. Then, too, you've got to use these cords inside plane wings and parts of the fuselage where gas vapors are highly concentrated. It doesn't take much imagination to guess what'd happen if a cord shorted there. We have to use the very safest—Hazacord!"

Hazacord can help you solve your cable safety problems too. For full details, contact your nearest Hazard representative or write for Bulletin H-451. Hazard Insulated Wire Works, Division of The Okonite Company, Passaic, N. J.

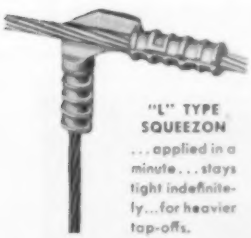
Nothing connects like Compression

KEARNEY
SLEEVES and SQUEEZONS
...are "musts" for modern construction

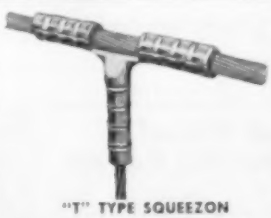
SERVICE ENTRANCE SLEEVES
...tight and neat, for connections of secondary to the service loop.



SQUEEZON
. . with exclusive "built-in spacer" for maximum conductivity . . . minimum corrosion.



"L" TYPE SQUEEZON
. . . applied in a minute . . . stays tight indefinitely . . . for heavier tap-offs.



"T" TYPE SQUEEZON
. . maximum strength and conductivity for heavy-duty uses.

To safeguard today's construction, you need the tight-gripping strength and high conductivity of KEARNEY Sleeves and Squeezons.

These trouble-saving compression connectors are the result of many years of KEARNEY engineering research and field testing. They are now available in tested types and sizes to meet every above-ground construction requirement.

To save time in construction . . . and to save trouble for years to come . . . make sure your crews are using genuine KEARNEY compression connectors.

-284

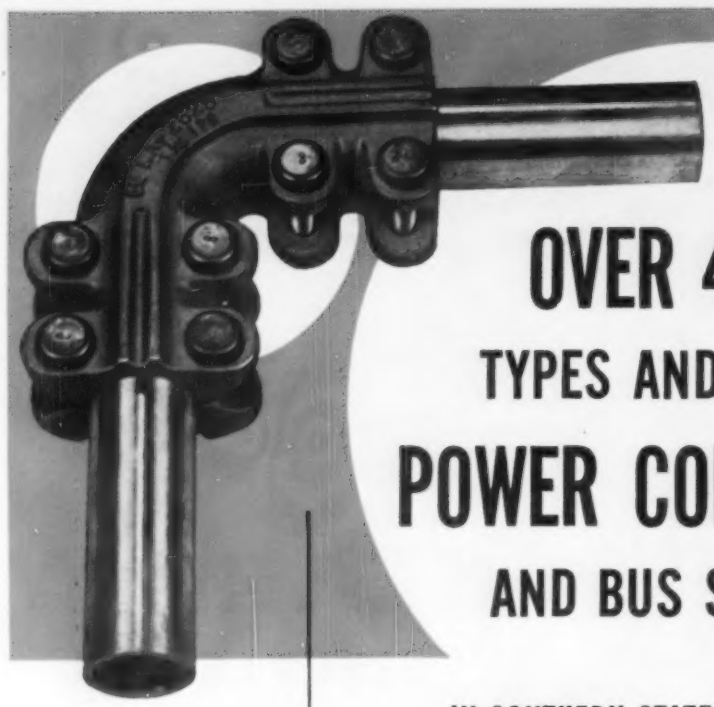
For Better Construction . . . Safer Maintenance

JAMES R. KEARNEY

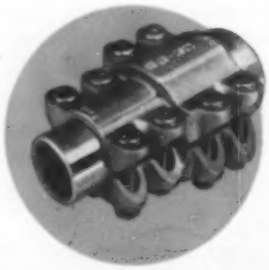
The Mark of Quality

Specify **KEARNEY PRODUCTS**

JAMES R. KEARNEY CORPORATION • 4224-42 CLAYTON AVENUE, ST. LOUIS 10, MISSOURI • Canadian Plant: GUELPH, ONTARIO



OVER 4,000
TYPES AND SIZES OF
POWER CONNECTORS
AND BUS SUPPORTS



IN SOUTHERN STATES' COMPLETE LINE

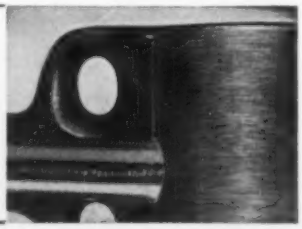
To meet the widest range of requirements for power and grounding connectors, Southern States produces more than 4,000 different types and sizes—many on special order to customers' specifications.

Widespread use of self-supporting, rigid, tubular bus constructions in substations has increased the mechanical requirements of many connectors. That is why Southern States connectors have been re-designed during the past two years. They now have stronger ears and are 40 to 50% heavier.

When you specify and use Southern States connectors, you can be sure they are capable of: 1) serving as self-supporting members; 2) providing good electrical connection; 3) developing full strength of clamping bolts without visible distortion; 4) carrying current equal to the conductor without excessive temperature rise; 5) being installed with a minimum of effort and time.

Rough Ground for Best Possible Contact

Every Southern States connector is rough ground on all contact surfaces. This permits the connector to bite into the conductor, causing intimate metal to metal engagement at thousands of high-pressure contact points, thus providing a better junction and one that is sealed against corroding atmosphere.



SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

BIDDLE *Instrument News*

BIDDLE CORONA TESTING EQUIPMENT

For Non-Destructive Evaluation of Electrical Insulation in Transformers, Cables, Capacitors and Other Electrical Components

for ionization starting voltage at 60 cycles

Models and Ratings to Suit Your Application

Ionization, corona and radio noise are synonymous in describing the phenomena which occurs when a high voltage gradient applied to voids in a dielectric causes ionization of the gas in those voids. The result is electrical disturbance and possible damage to insulation. The Biddle ionization test set offers a decided advantage in practical testing in that it makes possible the grounding of one terminal of the component under test.

The set includes all necessary connecting leads and accessory mercury oil terminal for use in testing samples of shielded cable. Model I rating ¾ KVA at 20 KV. Also available with 5 KVA intermittent rating.

Write for **Bulletin 66-EW**

JAMES G. BIDDLE CO.

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET
PHILADELPHIA 7, PA.

Insulation Tester & Wheatstone Bridge in One Easily Portable Instrument

Measures Electrical Resistances From a Fraction of an Ohm up to 1000 Megohms

Saves Cost of Two Instruments

Saves Testing Time

Affords the facility of:

- *A Wheatstone Bridge* for measuring conductor resistance of coils, resistors and circuits.
- *A Megger® Direct Reading Ohmmeter* for measuring electrical insulation resistance (ohm and Megohm scales).
- *A Varley Loop Feature* for locating faults on wires (optional).

This Bridge-Meg weighs only 15 lbs. and is completely self contained with its own constant-voltage generator—no need to be dependent on batteries or other suitable test current.

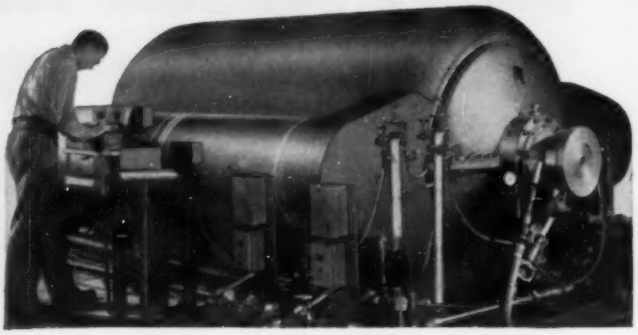
Why burden yourself with two instruments when you can have the facilities of two for little more than the price of one in one compact, sturdy case. For complete details and prices write for **Bulletin 21-60-EW.**

Whatever your requirements in electrical resistance testing follow the lead of electrical men everywhere—*insist on Megger Instruments—with the long, trouble-free life line.*

James G. Biddle Co. 8-555
1316 Arch St., Phila. 7, Pa.
Gentlemen:
Please send me material checked:
☐ 66-EW ☐ 21-60-EW

NAME
JOB FUNCTION
COMPANY
ADDRESS

Fully Super



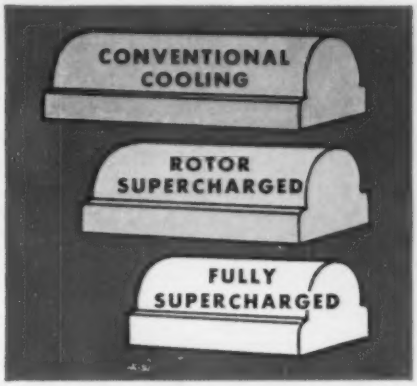
TEST UNIT establishes a basis for designing 3600-rpm units that can be rated 300 mw and higher. On initial test setup, the fully supercharged generator was given heat runs at various hydrogen pressures. Tests showed the output is more than doubled as a result of fully supercharged cooling.

Designers' model approximates appearance of fully supercharged generator on 150,000-kw steam turbine unit.

A-C ALLIS-CHALMERS

ALLIS-

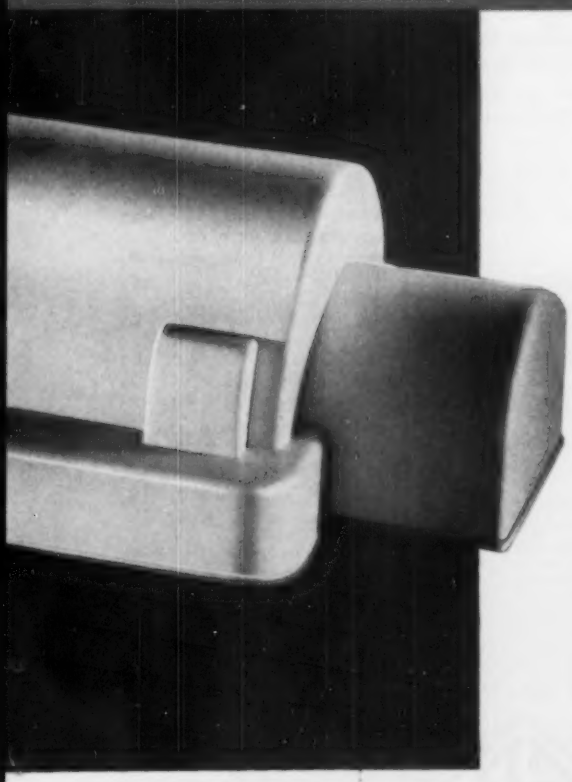
charged cooling!



OUTLINES SHOW ADVANTAGES in comparable length . . . first with rotor supercharging . . . and now with full supercharging to reduce size even further.

Now

Allis-Chalmers reports on tests of a generator with supercharged cooling of both rotor and stator



EXPERIENCE shows that supercharged cooling pays off. The Allis-Chalmers pioneered development, applied to rotors only, already delivers important savings to utilities. Five steam turbine-generator installations now have a combined total of eight years' operating experience. Plants can be smaller, less costly to build. Switchgear costs are lower. Shipping and installation are simplified. Important operating advantages have been proved.

A fully supercharged generator test unit — with supercharged cooling applied to both rotor and stator — has now been built. It has mechanical, magnetic and cooling features which permit maximum utilization of Allis-Chalmers supercharged cooling design. This design provides conductor cooling with high velocity gas flowing over ample exposed area.

Performance surpassed expectations

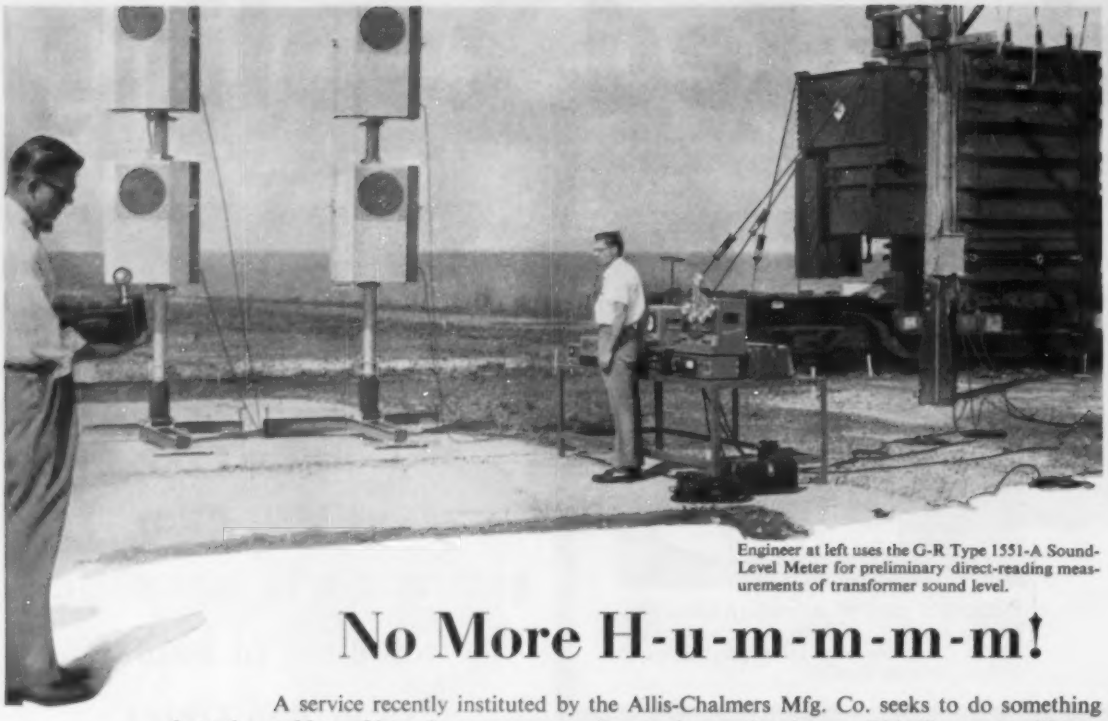
Test efficiencies exceeded predictions and temperatures were favorable. Electrical characteristics were exceptionally favorable. Mechanical features, including thrust-type hydrogen seals, proved unusually effective.

Overall tests show that fully supercharged cooling — of both rotor and stator — will provide steam turbine generators with advantages in size and performance far superior to previously built designs.

Complete information on these tests is available in "Fully Supercharged Generator — Performance Exceeds Expectations." Get a copy from your nearby Allis-Chalmers office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-4661

CHALMERS



Engineer at left uses the G-R Type 1551-A Sound-Level Meter for preliminary direct-reading measurements of transformer sound level.

No More H-u-m-m-m-m!

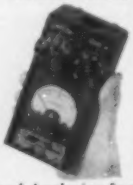
A service recently instituted by the Allis-Chalmers Mfg. Co. seeks to do something about the problem of hum from power transformers in populated areas. This Company will now measure and analyze transformer noise for customers at the Allis-Chalmers outdoor laboratories in Carrollville, Wisconsin, a location having inherently low background noise. By superimposing the transformer sound-spectrum on a recording of the actual ambient noise existing at the proposed site, the complete response of the transformer can be accurately predicted.

Allis-Chalmers engineers rely heavily on G-R Sound-Measuring and Analyzing equipment for their work. These instruments, of advanced design and highest reliability, are portable, battery operated, and completely self-contained for simple operation in practically any location. They include:

Type 1551-A Sound-Level Meter, $360
. . . basic sound-measuring tool for reading the sound-pressure level at its microphone in terms of the standard A.S.A. reference level.

Type 760-B Sound-Analyzer, $520
. . . for narrow-band measurements of pitched sounds . . . best suited to measuring noise emitted by rotating, reciprocating or other cyclic mechanisms where prevalent frequency components are harmonically related to motor speed or other characteristic.

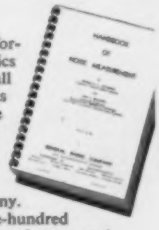
Type 1550-A Octave-Band Noise Analyzer, $535
. . . for rapid, convenient broad-band analysis of "unpitched" sounds where the noise energy is widely distributed over the audio spectrum and is usually caused by shock excitation, impact or turbulence.



Type 1555-A Sound-Survey Meter, $135
. . . low-cost, pocket-size sound-level meter for preliminary investigations prior to detailed study and analysis with above equipment.

Also available are Vibration Measuring and Analyzing Instruments . . . Sound-Level Calibrator . . . and Dynamic, Condenser and High Sound-Pressure-Level Microphones for specialized work with the Sound-Level Meter.

Noise Reduction is the aim of an ever increasing group of organizations engaged in a wide variety of endeavors. These people recognize noise for what it is . . . wasteful energy which, at best, is a distracting influence reducing human efficiency.



Should you need basic information on the characteristics of sound and the overall problem of noise and its measurement, ask for the HANDBOOK OF NOISE MEASUREMENT by Dr. L. L. Beranek of MIT and Dr. A. P. G. Peterson of the General Radio Company. This publication of over one-hundred pages describes measuring equipment and techniques, interpretation of results, and the most fruitful approach toward minimizing detrimental sounds. The HANDBOOK is available from G-R at $1.00 to cover printing and mailing costs only. To avoid unnecessary clerical expense, please enclose check or dollar bill with your order.

WE SELL DIRECT, Prices are Net, FOB Cambridge or West Concord, Massachusetts

GENERAL RADIO Company

1915-1955
40 Years of Pioneering in Electronics

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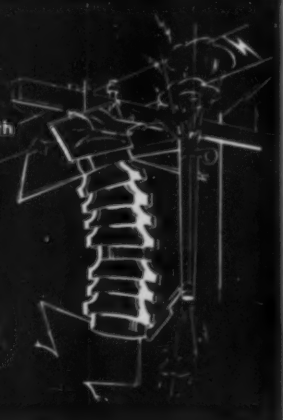
920 S. Michigan Ave. CHICAGO 5
1000 N. Seward St. LOS ANGELES 38

JOSLYN presents a new development

in distribution cutouts

EXTRA HEAVY DUTY OPERATION WITH SINGLE VENTING

New Coaxial tube fuse holder permits extra heavy duty operation with single downward vent. It doesn't have to "BLOW ITS TOP" to withstand high fault currents.



UPWARD GAS FLASHOVER HAZARD ELIMINATED

RATING OF 100-AMPERE CUTOUTS

Kv. Rating	Interrupting Capacity—Amperes R.M.S. Heavy Duty	Extra Heavy Duty
5.2	5,000	10,000
7.8	5,000	10,000
15.0	4,000	8,000

18 Kv Rating (1,200 amp. interrupting) Cutout also available

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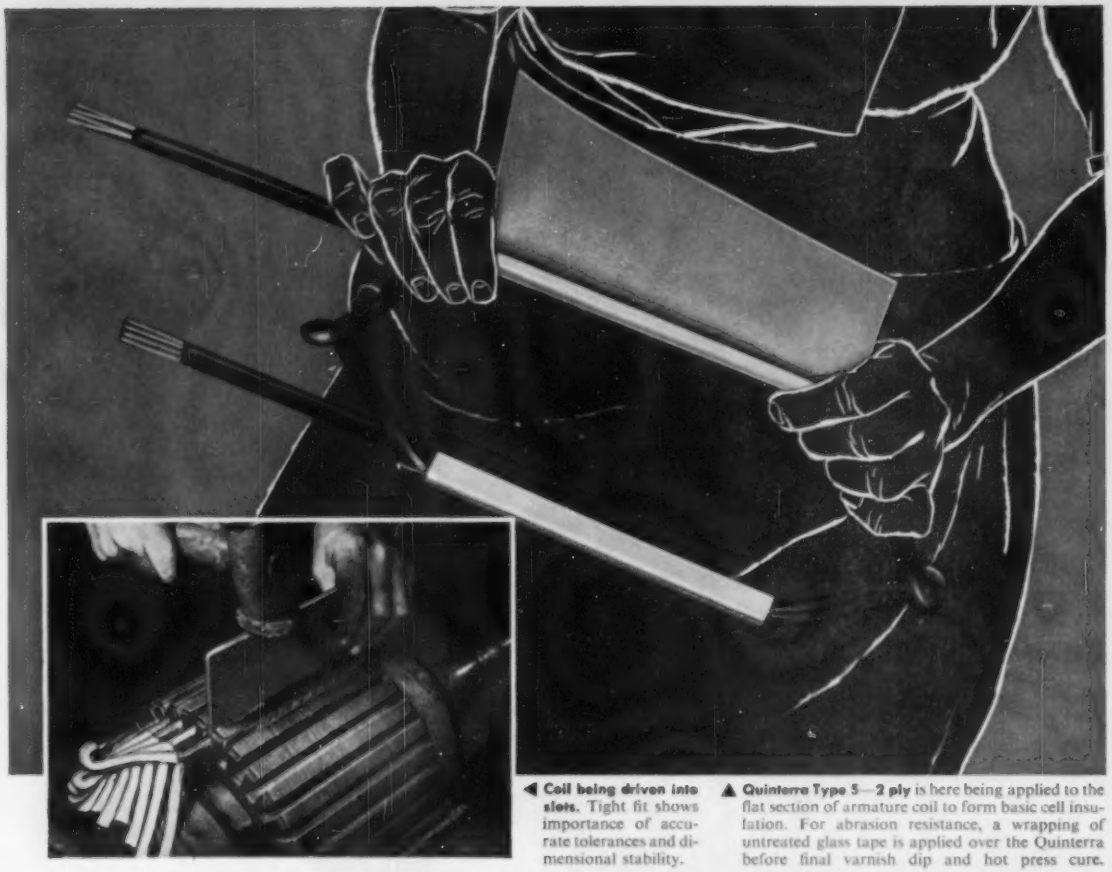


◀ **Coil being driven into slots.** Tight fit shows importance of accurate tolerances and dimensional stability.

▲ **Quinterra Type 5—2 ply** is here being applied to the flat section of armature coil to form basic cell insulation. For abrasion resistance, a wrapping of untreated glass tape is applied over the Quinterra before final varnish dip and hot press cure.

Why West Virginia Armature Co. switched to J-M QUINTERRA® for armature coil insulation

West Virginia Armature Co., Bluefield, W. Va., is a leading manufacturer of motor armature coils, used by the coal mining industry—a severe and difficult field. It was only after 4 years of field testing that they decided to change to Johns-Manville Quinterra Type 5—2 ply for their traditional built-up insulation materials. They made this change because they discovered that:

1 Quinterra retains higher inherent dielectric strength under prolonged high temperature operating conditions.

2 Quinterra, manufactured to closer thickness tolerances, permits more accurately dimensioned coils, assuring easy and proper fit.

3 Quinterra is pliable, conforms readily to shape of coil and remains dimensionally stable in storage or in use.

4 Quinterra is smooth, does not crack or flake, is easy and pleasant to handle, does not harm or irritate operators' hands.

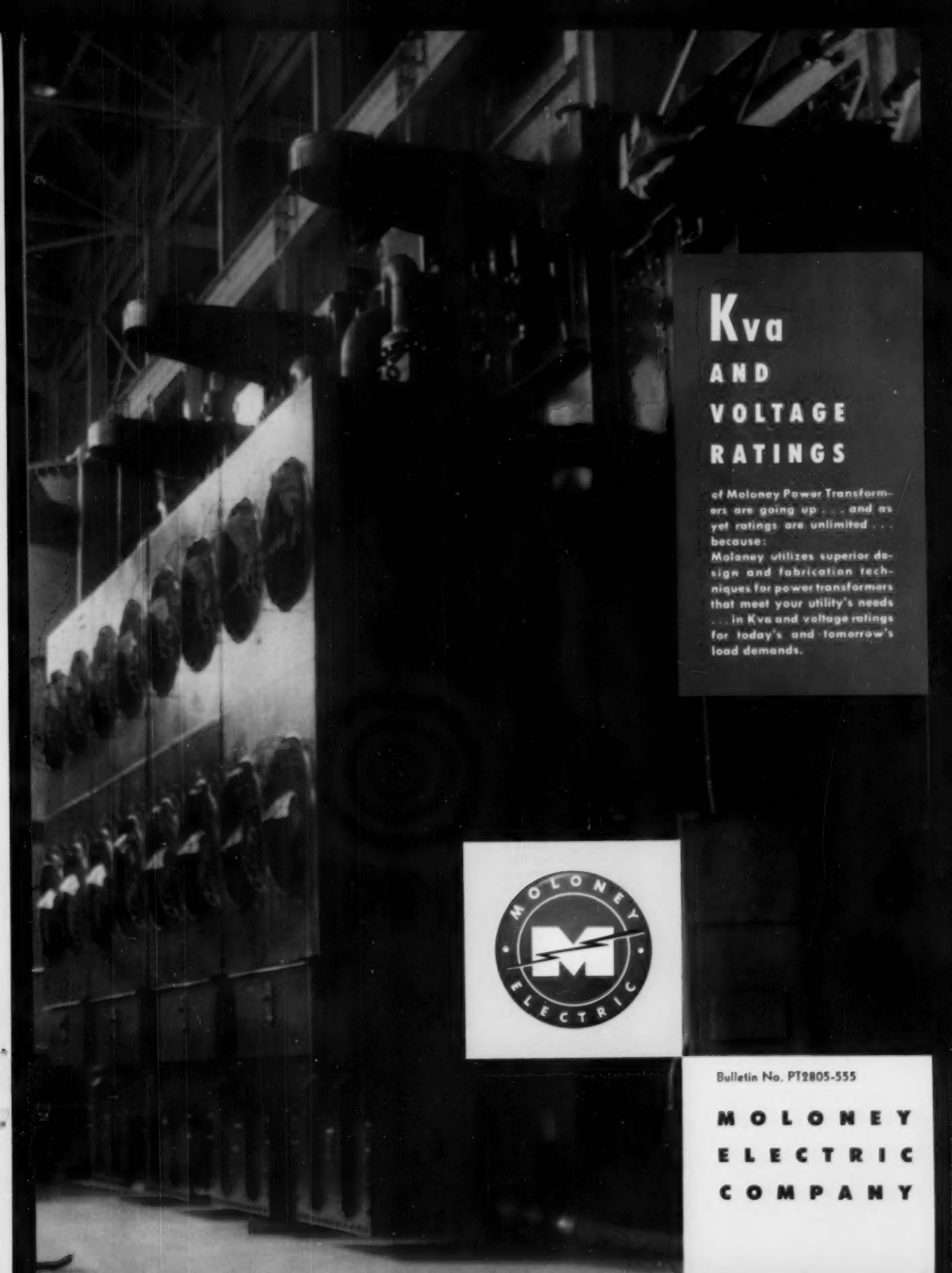
5 Quinterra is flexible, eliminates dielectric failures due to flaking or splitting.

Quinterra Type 5—2 ply is made from two sheets of highly purified asbestos treated with a polyvinyl acetate resin saturant and combined under controlled temperature and pressure. It has ample mechanical strength for easy handling. Its inherent dielectric strength exceeds 280 VPM even at temperatures over 130 C.

Find out how you can obtain the same benefits from Quinterra. Write for free 32 page illustrated brochure, EL-40A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit (Toronto), Ontario.

Dimensional accuracy is imperative. Here, finished coils are being tested in Go-or-No-Go gauge.

Johns-Manville ELECTRICAL INSULATIONS



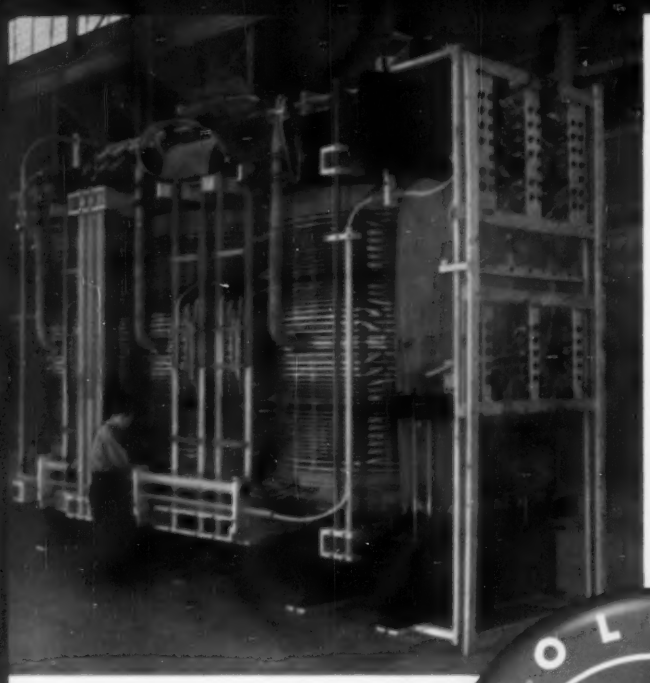
Kva AND VOLTAGE RATINGS

of Moloney Power Transformers are going up . . . and as yet ratings are unlimited . . . because:
Moloney utilizes superior design and fabrication techniques for power transformers that meet your utility's needs . . . in Kva and voltage ratings for today's and tomorrow's load demands.

MOLONEY ELECTRIC

Bulletin No. PT2805-555

MOLONEY ELECTRIC COMPANY



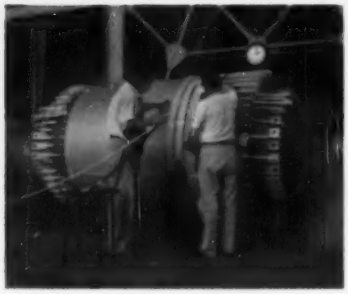
MOLONEY POWER TRANSFORMERS ARE BETTER . . .

because of:

- **proved design techniques**
- **proved fabrication methods**
- **proved plant facilities**
- **proved performance characteristics, certified by Moloney's unsurpassed testing facilities.**

MOLONEY ELECTRIC

Litho in U.S.A.



Specify Moloney . . . Get Dependability at its Best . . . All Along the Line

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Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers • Industrial Dry Type Transformers • Capacitors • Magnetic Components for Electronics

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EDITORIALS

Quick Recovery Utility Systems

Would an atomic blast obliterate a utility system? Would months and maybe even years be required to rehabilitate it in order to serve the area's homes and factories?

These are questions of interest to utility customers, both residential and industrial. Such questions may also come from state and federal lawmakers and from Civil Defense officials.

A brief answer is that electric utilities would be able to restore vitally needed electric service before residents could occupy their homes following an atomic blast. Industrial plants would have service restored by the time production lines were ready to roll.

Documentation of these answers is to be found in the recently released "Effects of an Atomic Blast on Electric Power Facilities," an easy-to-read 19-page booklet available from Edison Electric Institute. This is the report of the three-man EEI Nevada Atomic Test Committee which studied atomic blast effects on utility facilities.

The popularly presented report carries numerous pictures and charts which vividly illustrate its findings and conclusions. It describes the Yucca Flats, Nev., tests from their organization to their final results. But more importantly, it interprets these findings in terms of what an operating utility might experience under similar circumstances.

The report should prove a valuable tool in appraising the public and government officials of the rehabilitation potential of utilities following atomic catastrophe.

Look to the High Schools

It is apparent that more high school students must be guided toward an engineering career if this country is to solve its rapidly mounting engineering shortage. Only about 22,000 engineering graduates will be available in June for some 40,000 which are estimated to be needed. At the same time the proportion of high school students preparing for engineering training has dropped in the past four years from 12.1% to 7.6%.

Dean S. C. Hollister, Cornell University College of Engineering, recently noted that high school teaching staffs are weak in the fields of mathematics, physics, and chemistry—the basic subjects leading to engineering training. He offers these suggestions for alleviating the engineering shortage and guiding more talented students toward a utility career:

- Furnish qualified company personnel for part-time teaching in the basic fields in high schools. Besides contributing a needed public service, this would help to assure the flow of technical personnel to the companies themselves.
- Stimulate interest of the high school students in what is going on in the electrical industry. Much needs to be done to instill a sense of importance in the industry and pointing up its opportunities for the young engineers."

Both these suggestions merit earnest consideration. It is imperative that industry make provision for its personnel requirements if government intervention is to be avoided.

Sense of Fair Play

"No amount of brilliant explaining will ever make an income tax-burdened public respect the income tax exempt cooperatives." This statement comes from R. Powers Luse, manager of the Hancock Wood Electric Cooperative, North Baltimore, Ohio.

Writing in a recent issue of "Co-op Power," Luse offered his own list of weaknesses of rural electric co-ops. The failure to accept income tax responsibility, he listed as one of these weaknesses. Luse believes that the public distaste for tax exemptions of this sort might easily lead to legislation unfavorable to the co-ops.

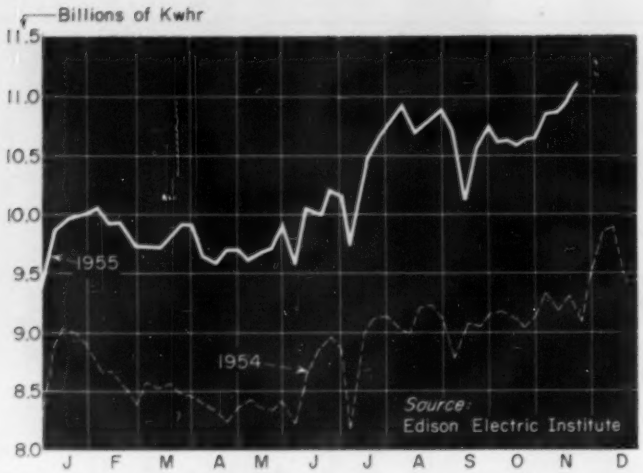
Now Luse is no detractor of co-ops or the co-op movement. In the same article he praises co-op accomplishments. He points out the weaknesses of co-ops only that they might be overcome. In recognizing tax exemption as one weakness, Luse has shown a good sense of fair play.

Make It a White Christmas

United States Steel is giving utility load-building programs another shot in the arm during the pre-Christmas season with a repeat nationwide appliance promotion campaign. With a much bigger program than last year, the major steel firm is urging Mr America to "Make it a white Christmas—give her a major appliance."

As last year, U. S. Steel offers all sorts of tie-ins for local advertising. Utilities which can find the money in their waning advertising and promotion budgets will want to consider the tie-in offers.

But whether they tie-in or not, the utilities should feel some encouraging effects from the nationwide promotion.



OUTPUT MARK SET*

Week Ended Nov. 19
11,149,000,000 Kwhr
Up 19.7%

* First 11-billion kwhr week

Atomic Energy Commission requirements — 1,071,000,000, kwhr (Electrical World estimate). Excluding AEC output increase was 14.5%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Nov. 19	+19.7	+10.9	+10.3	+28.9	+14.2	+19.8	+16.0	+18.4	+29.1	+16.5
Nov. 12	+18.3	+10.6	+9.9	+30.3	+12.4	+20.2	+13.7	+15.6	+13.8	+12.4
Nov. 5	+16.0	+10.9	+8.8	+27.2	+8.1	+16.1	+13.5	+14.9	+12.5	+11.5

Seasonally Adjusted Index 210.7 Week Ago 207.2 Year Ago 175.7

Issue's Highlights—AEC's legal staff sees possible law violation in Dixon-Yates contract, recommendation could result in government avoiding $2-million cancellation fees . . . Westinghouse strike deadlock continues after intensive negotiation session . . . Indiana PS appeals $4.2-million rate hike denial by PSC . . . Stevens County (Wash.) voters prepare to choose between service by PUD or Washington WP . . . Corps of Engineers' water-storage plan blocks Potomac Electric's 300,000-kw plant.

Pelton Decision Defended—U. S. Supreme Court's decision last June upholding FPC's award of license to Portland GE to construct Pelton Dam over objections of Oregon and other parties was attacked again at recent Columbia Basin Interagency Committee meeting. But decision is final, said FPC's chief counsel, W. W. Gatchell "And to circumvent it, even by federal legislation, verges on anarchy. Are you going to permit continued development of water for hydro power under FPC license, or are you going to require only U. S. itself engage in production of power in the west?"

Memphis—Burns & Roe, consulting engineers, have told Memphis Light, Gas & Water division that proposed $100-million, 600,000-kw municipal power plant can produce power at about 4 mills per kwhr—about what MLG&W now pays TVA. In another development, TVA Chairman Herbert Vogel is reported to have told Memphis officials TVA will continue to sell needed power to Memphis after expiration of existing contract. But cost of such power probably will be higher than rate now being paid because TVA will have to buy power from outside its own generating facilities.

Service Entrance Requirement—West Penn Power, effective Jan. 1, 1956, will raise its minimum service entrance requirement from 70 to 100 amps. This requirement will apply to both the conductors and entrance equipment and be applicable in all individual installations having more than one branch circuit.

Smog Control—Los Angeles County Board of Supervisors has passed set of resolutions aimed at smog control and effecting burning of fuel oil by power companies, among others. Resolutions include endorsement of policy (now being tested in case of Southern California Edison) of allowing Air Pollution Control District Board to reject all permits for construction of power plants burning fuel oil.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire—AEC last week began last phase of policy hearings with industry representatives on new regulatory program dealing with peaceful application of atomic energy. Groups meeting with AEC were utilities, manufacturers, chemicals, and research. AEC, for some time, has been operating under tentative regulations but final approval is expected to follow hearings . . . SEC has issued order stating the Interstate Power has ceased to be a holding company.

Santee-Cooper—Special nine-man committee investigating Santee-Cooper finances has adjourned hearing until Nov. 30 following two-day inspection of the public power project. During inspection group closely questioned General Manager R. M. Jefferies on his dual capacity (he is also state senator) and about legal fees paid him and his firm by Santee-Cooper. He told committee initial legal bill totaled $181,000 but that it had been "compromised" at $87,500. Committee noted that $56,000 of federal funds had been applied against the fees.

Rate Law Change Urged—Ohio PUC commissioners are not in agreement on whether state's utility rate fixing law should be changed. Commissioner E. J. Kenealy told legislative committee studying question present law should be changed to make it less costly to figure utility rates. Commissioner R. Winter said he could make no recommendation without knowing more about possible effects of change. Law in question allows utilities to earn reasonable return on what it would cost to replace property new less depreciation.

Atomic Power—Babcock & Wilcox atomic research group has reported to AEC that liquid metal as atomic fuel is believed to be technically feasible in near future. They estimate that 226,000-kw nuclear power plant could be built and operated for cost of 7.1 mills a kwhr.

Co-ops in the News—Inland P&L, Spokane, will reduce electric rates effective Dec. 1 an average of 8¼% . . . Co-op taxation in Wyoming is shaping up as major issue for state's 1957 legislature. Wyoming Farm Bureau is latest group to call for modification of present taxing which is on same basis as for private utilities.

ABOUT PEOPLE IN THE INDUSTRY

Democrat presidential candidate Adlai Stevenson gave this indication of his power policies in recent Chicago address: "Today's fast dollar is being put above tomorrow's needs—Hells Canyon goes to a private company for only partial development of its power; an effort is made to sabotage the preference clause in our public power contracts, and to cripple the great rural electrification program; the dubious Dixon-Yates deal is contrived in secrecy and the TVA attacked publicly."

The fallacy of the public power yardstick was pointed up again last week when Duke Power's Vice President C. S. Reed addressed New York Security Analysts. In 1924, he said, bill for 100 kwhr in Charlotte was $8.10. "By 1934, which was before the government started showing us how to do it, this bill had been reduced to $4.20." Today the bill is $3.36. "Note that we came down almost $4 in the bill in ten years from 1924 to 1934 and have decreased it less than a dollar in last 20 years when public power folks have been teaching how to make rates."

More News About People page 148

AEC Lawyers Question D-Y Contract

- **Wenzell's role in negotiations held violation of conflict-of-interests**
- **No payment on cancellation fees seen if AEC adopts view of legal staff**

The Dixon-Yates contract has snarled in another tangle which may unravel in a decision relieving the government of any liability for payment of cancellation fees.

Cancelled several months ago by President Eisenhower when Memphis announced it would not, after all, need any power from the proposed 600,000-kw plant, the contract has been the subject ever since of a discussion involving the government's liability to the Dixon-Yates firm.

The contract provided that, in event of cancellation, the government would be liable for the amount the firm had spent in getting the plant underway.

Atomic Energy Commission lawyers are now of the opinion that the contract was born under questionable circumstances—that the dual role of Adolphe Wenzell, vice president of First Boston Corp and consultant to the Budget Bureau, represented a violation of the conflict-of-interests law.

According to testimony before two Congressional committees earlier this year, Wenzell was present at conferences in Washington during negotiations which led to the Dixon-Yates contract. His company later handled financing for the Dixon-Yates firm, Mississippi Valley Generating Co.

As EW went to press, AEC General Counsel William Mitchell had not made up his mind whether his staff's brief should be passed on in its entirety to the commission or not. Nevertheless, other Washington officials predicted he would. Mitchell previously had submitted an opinion opening the way for payment of cancellation fees.

If the AEC adopts its legal staff's view, it means that one party to the contract is declaring it null and void —the brief calls it "void or voidable"—and therefore considers itself free of any liability for cancellation penalties. In this event, Dixon-Yates must sue to recoup costs pumped into the plant site before Eisenhower acted. The figure involved is somewhere in the neighborhood of $2 million.

The current hassle concerns only about $2 million in down-the-drain costs, but Democrats are sure to try to make political hay out of the conflict-of-interests angle.

And in event of a court decision, a precedent could be set showing at just what point a conflict of interest, or dual employment, "poisons" a contract. That is, the court would decide just how far along in negotiations leading up to a contract offer and acceptance a government-industry participant would have to be involved before a real conflict of interests developed.

McNary's 10th Operates

Tenth 70,000-kw hydroelectric generator at McNary Dam on Columbia River recently went into operation 60 days ahead of schedule as the Corps of Engineers switched output into Bonneville Power Administration's substation.

Westinghouse, Union Deadlock in 7-Day Bout

Officials of Westinghouse Electric Corp and the International Union of Electrical Workers, CIO, recently concluded a seven-day session at the negotiation table in New York City. It appeared that both sides were still more firmly entrenched in the stalemate which is keeping more than 45,000 IUE workers off the job. (EW, Nov. 14, p 110).

This description of the negotiating session was given by Westinghouse's Vice President Robert D. Blasier:

"After two months of negotiations and one month of strike, the IUE-CIO leaders still have not even discussed or considered the five-year wage and benefit offer by Westinghouse in the union-management negotiating sessions.

"We have just completed seven days of meetings in New York. Practically the entire seven days were spent on one subject—the daywork time study question in which the Union now has resurrected the unpopular East Pittsburgh strike of August-September and is fighting that battle all over again."

The company official declared that during the sessions Westinghouse made four separate proposals on ground rules for the daywork time studies to boost the total to seven proposals on this subject. However, "the Union's contributions consisted of merely taking two of the company's proposals and rewriting them so as to limit the company's right to make time studies," Blasier said.

"Whether this question has become the Union's number one issue in this strike nobody knows. In their public statements they have shifted from one objection to another with such fast footwork that it is virtually impossible to know just what the main problem is," Blasier declared.

There still has been no collective bargaining of any kind on the Westinghouse package offer, the company's vice president noted. "Our entire five-year offer—as we have said many times before—is equal in value to the GE five-year settlement which IUE called 'a splendid settlement' in August," he observed.

"For the first time in Westinghouse history we have offered arbitration of grievances in an effort to eliminate strikes," Blasier stated. This provision would cover disputes "of the very same type" as those under the arbitration provision of the GE-IUE contract, he said.

The IUE issued this reply Nov. 21 in a newspaper advertisement:

"The strike of 55,000 Westinghouse employees is going into its sixth week. Why? Because, basically, the company has broken its contract with IUE-CIO.

"That contract was negotiated last year for a two-year period and pro-

vided for a wage reopening this year.

"In September Westinghouse demanded that IUE-CIO abandon that contract and accept one for five years."

To try again to break the deadlock, John R. Murray, Federal Mediation Commissioner, announced as EW went to press that negotiations on the strike issues would be resumed.

Westinghouse Will Supply Belgium's Power Reactor

Belgium plans to install an 11,500-kw atomic power plant to provide electricity for the Brussels World's Fair starting April 1, 1958. The plant, utilizing a pressurized water reactor, will be built by Westinghouse Electric Corp for operation by the Belgian Syndicat d'Etude de l'Energie Nucleaire.

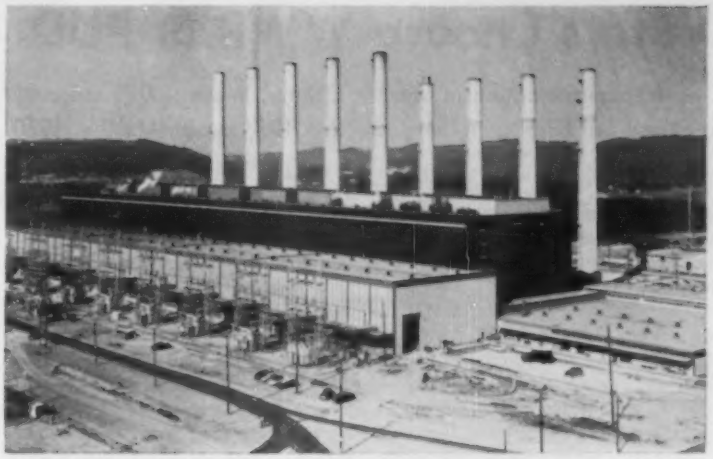
Fuel elements for the unit will be fabricated by Westinghouse from special material furnished by the Atomic Energy Commission under a special agreement between AEC representatives and Belgium as outlined in the Belgian government's bilateral agreement with the U.S., signed earlier this year.

Spokesman for the Belgian group here was J. van der Spek, manager of the Syndicat, an organization of 20 Belgian utilities and manufacturers which was formed recently to develop industrial uses of atomic energy in that country.

He said Union Miniere du Haut Katanga, a Syndicat member, "is the world's leading producer of uranium, and . . . the U.S. is the world leader in putting atomic energy to work for peacetime purposes. We deem it highly fitting that Belgium should be the home of what will be the world's first operating atomic-electric power plant to be financed entirely with private capital and that Westinghouse should build that plant."

William E. Knox, president of Westinghouse Electric International Co, has announced that the company will also furnish the services of its engineers and scientists to insure proper operation of the plant. In addition, Knox pointed out that the company will provide training facilities in the U.S. for the Belgian concern's operating personnel.

Work on the project, to be located near Brussels, is already underway in both countries.



TVA Completes Kingston Plant

Completion of ninth and last unit of Tennessee Valley Authority's Kingston Steam Plant, described by TVA as the world's largest, was celebrated by company employees recently.

The $213-million plant, which has a rated capacity of 1,440,000 kw and a capability of 1,600,000 kw, is located on Watts Bar Lake, near the atomic plants at Oak Ridge. Each generating unit was placed in operation as it was completed, and the ninth unit is expected to go into commercial operation in the near future.

Indiana PS Sues to Up Rates

- **Appeal for $4.2 million rate hike filed in circuit court**
- **Public Service Commission denied petition for increase**

An appeal in the Hendriks Circuit Court has been filed by the Public Service Co of Indiana to set aside the recent order of the Indiana Public Service Commission, denying the company's petition for a $4.2 million increase in rates.

The company stated in its appeal that "the revised rates are necessary to protect its credit position among investors from damaging deterioration and to bring its annual net earnings up to, and sustain them at, a level fair to present investors in its securities and sufficient to attract necessary new capital to enable it to maintain adequate and efficient service for the areas in which it operates."

In the order, the PSC ruled that the company was entitled to a 5.40% return, or $16,335,000, on its property. Commission accountants figured the utility is earning $16,541,914 or 5.4%. Present rates are "adequate," the PSC said, and there is "no current economic trend that appears to challenge the company's financial well-being."

Company's Pres R. A. Gallagher said, "Public Service Commission of Indiana established a completely unrealistic and wholly inadequate return of 5.4% on a value which approximates the book value, ignoring the heavy inflation which has taken place in the past ten years. And then, without reason, the order brushes aside the investment of present security holders with this statement: 'Present holders of Service Company securities are free to dispose of them in a free market on the day of their own choice and, therefore, are not in any way subjected to investment servitude by rate of return determinations by this commission.' "

The company, Gallagher said, intends to pursue every legal means necessary to eliminate the potentially devastating effects of the commission's order, and to re-establish its credit position so that it may continue to carry out its obligation to provide adequate service.

Voters Choose WWP or PUD

. . . in special election in Stevens County, Wash.; 60% majority required in first such vote since PUDs established in 1930

Voters in Stevens County, Wash., prepared to go to the polls last week to decide whether the county's PUD properties should be sold to Washington Water Power Co.

The election marks the first time since 1930, when the PUD's were established, that the people of a county have had an opportunity to vote on whether or not they will be served by a private utility or a PUD.

Stevens County, which juts southward 100 mi from the Canadian border in northeast Washington, voted in 1936 to establish a public utility district. The ballot for the special election which may reverse the decision, reads: "Shall Public Utility District Number One sell all its electrical transmission, distribution, and associated properties to the Washington Water Power Co for $2,905,000?"

The 1930 law gives a PUD the right to seize water and power properties without a vote. And in 1953 the Stevens County PUD began action to condemn WWP properties. The private utility then offered to buy the PUD holdings.

PUD officials declined the offer. But after a petition was presented demanding an election, the PUD arranged to let the voters decide. According to law, however, a mere majority is not enough.

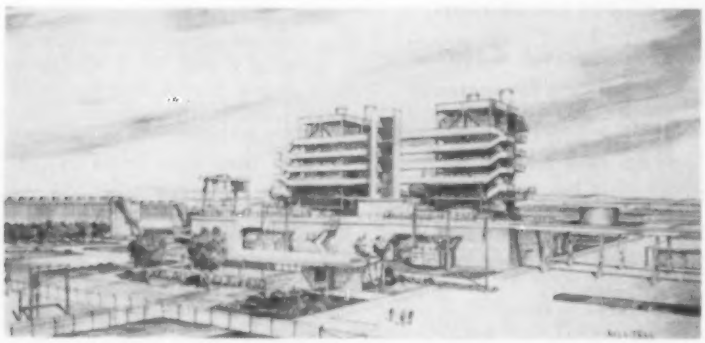
A PUD can be put out of business, even temporarily, only if 60% of the votes cast say so. Should the election outcome favor the PUD, then WWP's holdings in Stevens county will be sold to the PUD for $3.1-million according to a pre-election agreement between the utility and PUD officials.

By law, even if WWP won the election, the PUD could still begin new condemnation proceedings against the utility's properties. The PUD has specified, however, that it will wait five years before trying to seize the utility again.

WWP officials are confident that if they win the election, they will stay in the saddle indefinitely in Stevens County. To assure a victory for the utility, its president, Kinsey Robinson, has been speaking throughout the county at mass meetings. And WWP employees have been conducting a door-to-door campaign.

Presenting the case for the PUD, three Deputy Masters of the State Grange have spent considerable time in Stevens County. And the PUD has pushed hard with posters, newspaper advertisements, direct mail, and some door-to-door solicitation.

Whatever the outcome of the election, the last two months have been exciting ones for quiet, agricultural Stevens county.



Agua Fria Will Add 100,000-kw Unit

Shareholders of the Salt River Power District in Arizona have voted an additional $10-million bond issue to permit construction of another 100,000-kw unit at the planned Agua Fria Plant (shown in artist's sketch above).

With this additional unit, the plant will have a total output of 200,000 kw and will cost about $25 million. It will be located on an 80-acre tract between Glendale and Peoria in Arizona.

Design for the plant is semi-outdoor. To speed efficiency of operation, an elevator for freight and passengers will be installed in the structure which will be as high as a 10-story building. Two 17-in. television sets will be used on a closed circuit to assure proper fuel burning and to watch the boiler drum's water-level gauge glass. Natural gas will be the principal fuel.

Convention to Discuss Atomic Energy Progress

Latest nuclear energy developments will be discussed by outstanding researchers at the Nuclear Engineering and Science Congress, to be held in Cleveland, Dec. 12 through 16.

Papers covering atomic energy progress from uranium ore deposits to the new use of radioactive isotopes will be read before representatives of industry, government, and education and 25 national engineering and science societies. Many of these papers have been declassified by the Atomic Energy Commission to permit presentation at the congress.

In addition to talks on the theory and application of nuclear energy, delegates will view the American Institute of Chemical Engineers' Atomic Exposition, which displays the actual tools of atomic energy in full size and model reactors and equipment.

NEWS BRIEFS

New Memphis (Tenn.) mayor is Edmund Orgill, backer of the municipal plant to supply power now generated by Tennessee Valley Authority. Plans for the city to build the $100-million plant led to cancellation of the Dixon-Yates contract.

Failure to purge gas from an unlighted boiler caused an explosion and $200,000 damage to San Diego Gas & Electric Co's Silver Gate Steam Station, it was disclosed recently. The boiler was not restored to service for a month.

Two Plants Okayed

. . . by San Francisco voters for Hetch Hetchy system; each will have 54,000-kw capacity

Two new hydroelectric plants for San Francisco's Hetch Hetchy system received approval of the voters in a municipal election when a $54-million bond issue to finance the project won the required two-thirds majority.

The San Francisco projects are Cherry Valley, costing $23.5 million with capacity of 54,000 kw; and Early Intake No. 2, costing $23.7 million with 54,000-kw capacity.

San Francisco wants to develop the sites to obtain additional power revenues to offset operating costs of its water system and to pay for improvements.

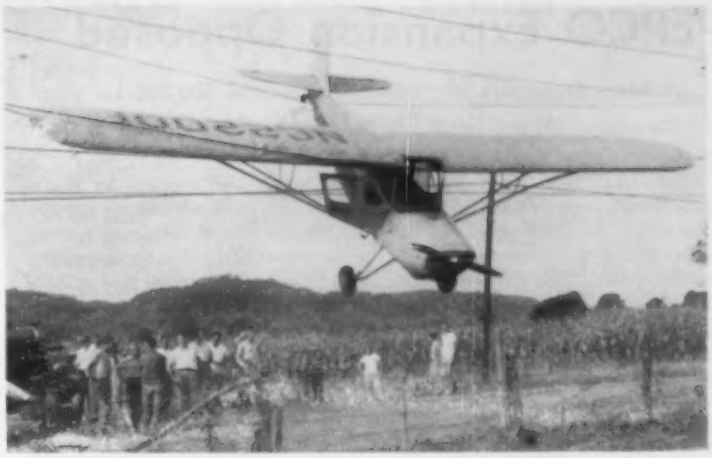
The Hetch Hetchy system, San Francisco's municipal water and power project in Yosemite National Park, 200 mi east of the city, is major source of the city's water. Hetch Hetchy power revenues ($80 million in the past 30 years) subsidize the water system keeping water rates low. Generating capacity of the Hetch Hetchy system is 86,000 kw—the combined capacity of Moccasin and Early Intake No. 1 powerhouses.

$4.8-million Revenue Expected

Hetch Hetchy power is sold to San Francisco municipal departments, some irrigation districts, and a few commercial users. Provisions of the Raker Act, 1913 legislation which grants San Francisco rights of way and use of public lands in Yosemite for the Hetch Hetchy project, prohibit sale of power to corporations or individuals (except public agencies) for resale.

The two proposed power plants, described as a self-liquidating project, are expected to bring in revenues of $4.8 million a year. Revenues from the two plants during the 15-year bond maturation period are expected to be $72 million—enough to retire the bonds (which will require $64 million including interest) and pay for further improvements in the water system.

Cherry Valley, on the Cherry River, is to operate in conjunction with Cherry Valley Dam, now under construction. Early Intake, on the Tuolumne River, is to utilize water from O'Shaughnessy Dam.



PLANE HITS HIGH-VOLTAGE LINES IN LOW-FLYING LANDING ATTEMPT

Two Planes Kayo'd by Power Lines

Two airplanes, in freak accidents, recently tangled with power lines—one near Cheshire, W. Va., because of a low-flying pilot; the other at Syracuse, N. Y., because of high-speed winds. Power was interrupted at both points, but no one was injured in the accidents.

Near Cheshire, a two-place Aeronca flew in too low for a landing at Ura Swisher's private airport. The craft, as it neared the field, struck two power lines, a 13,200v and a 12,240v, in the Columbus & Southern Ohio Electric Co system. Robert J. Poe, pilot, and William D. Bottoms, owner and passenger, were rescued by ladder. But the plane stayed suspended on the high-voltage wires until a crew from the utility lowered it to the ground again with a truck-mounted crane. The accident knocked out a circuit breaker, interrupting service in nearby Middleport for 18 minutes and in Cheshire and environs for more than two hours. The knocked-out circuit breaker was located 2 mi north of Middleport.

At Syracuse, 100-mph winds tore a plane from its moorings at the suburban Nedrow airpark and hurled it against a power pole. The high winds, classified as tornado speed by the U. S. Weather Bureau, also knocked out the street lighting system in the area.

100-MPH WINDS HURL MOORED PLANE INTO SYRACUSE UTILITY POLE

PEPCO Expansion Opposed

. . . by Army Engineers who contend proposed 300,000-kw plant on Potomac would pre-empt site for future water storage project

A projected Corps of Engineers water storage dam on the Potomac River above Washington, D. C. has been thrown into a local fight to prevent Potomac Electric Power Co from building a $100-million, 300,000-kw steam plant in northern Virginia.

Discussion of the Engineers' plans for the dam recently highlighted a hearing on PEPCO's proposal before a special Senate subcommittee headed by Sen Wayne Morse (D-Ore.). Col Ray Adams, of the District of Columbia Engineers' Center, brought up the dam in arguments against the new PEPCO plant, which would boost the company's ability to service the Washington metropolitan area from 780,000 kw to more than one-million kw.

Adams testified the dam will be needed by 1970. He said it would insure future water supplies for Washington and its mushrooming suburbs in Maryland and Virginia, provide supplemental irrigation for farmlands, and insure heavy stream flow at 650-million gallons a day to flush pollution past the city.

The Engineers' contention is that construction of the steam plant would pre-empt the dam storage site, since the plant would be built at an elevation of 210 ft above sea level, upstream from the dam. The dam, planned for elevation 240, would flood the steam plant site.

The dam proposition has been kicked around Washington for some time. When first proposed ten years ago as part of the Engineers' comprehensive plans for development of the Potomac Valley, senators from Virginia and Maryland led the opposition to it. They received support from historic and conservation societies. The Engineers shelved the plan about eight years ago.

Revival of the dam plan is the latest in a string of arguments against building the plant at the site the company has chosen. That site is a 519-acre tract on Virginia shoreline in Loudon County, 12 mi above Washington. The company obtained an option to buy which expired Nov. 1, but it has a 60-day extension on the purchase option now in effect.

The District Engineers have fought the plan on the grounds that it would boost the temperature of the river's water by about ten degrees, thereby incubating bacteria which would affect its taste and odor. PEPCO put experts on the stand recently to deny that the plant's heating effect would result in serious changes in the water's characteristics and to point out that it is needed to meet suburban load growth approaching 75,000 to 100,000 kw a year.

House Unit Probes Hoover Commission Recommendations

Rep Robert E. Jones (D-Ala.), as chairman of a House subcommittee, has been hedge-hopping across the eastern United States from New England to Alabama investigating recommendations by the Hoover Commission's task force on water power and resources (EW, April 25, p 46).

Along the way, the public-power minded Congressman, with an assemblage of sympathetic witnesses, managed to stir up some hard licks for the private utilities.

In Springfield, Mass., an assortment of witnesses testified that the public vs private power issue had retarded flood control in the area.

In rebuttal, Howard E. Caldwell, president of Western Massachusetts Electric Co, declared, "The New England-New York Inter-Agency Committee recently completed at great cost a sweeping study ordered by President Truman. This study indicated that potential power production would be a very insignificant by-product of flood control. . . ."

Later in Nashville, Jones stated that representatives of the Budget Bureau had endeavored to enlist the aid of a citizens' delegation to push private development of the lower Cumberland River.

Disclosure of the incident, Jones said, had come from Charles Everhart, president of Nashville Bargeline and a member of the Nashville delegation.

Everhart, appearing before the subcommittee, testified that the delegation had met with Budget Bureau officials in October to seek approval of a $2-million request for funds to start the Cumberland project.

Bureau spokesmen, Everhart said, "suggested if we could get them (some private utilities) interested in working out some arrangement to take over the investment in the power production facilities and distribution of power and then pay the federal government a nominal fee for the use of the water . . . that we would certainly have a far better chance of getting it started."

Budget Director Rowland Hughes promptly denied that he or any of his assistants had ever made such a recommendation. Jones said he would request a Congressional investigation of the matter.

Generally, as hearings continued in Memphis, Tenn., and Muscle Shoals, Ala., most of the testimony criticized the Hoover task force recommendations on the grounds that, if put into effect, they would stymie the Tennessee Valley Authority.

The witnesses included some longtime champions of public power: Gov James E. Folsom of Alabama; Alex Radin, general manager of American Public Power Association; Gov Frank Clement of Tennessee, and Democratic Senators Lister Hill and John Sparkman of Alabama.

Moving westward, the subcommittee hit Chicago last week. There Claude R. Wickard, former Secretary of Agriculture, testified the Hoover Commission's recommendations should be shelved because they deprived the public of future benefits.

Soviet A-Power Output

Soviet Union's atomic power output reached 20-million kwhr during the 17 months of the station's operation. Five kilograms (about 11 lbs) of uranium was used.

Utilities Blaze New Power Trails

Arizona PS Aided by Ferry

To string its new 33-kv line into the recently reclaimed and electrically virgin Cibola Valley, Arizona Public Service Co utilized the rustic Cibola Ferry, owned by a group of valley farmers.

The line, energized at 12 kv, transmits power across a 400-ft span of the Colorado River to help 20th Century pioneers make their valley one of the rich farming areas of the state. Since 1951, 6,000 acres of a possible 20,000 have been reclaimed.

Because of the inaccessibility of the valley, Public Service arranged to purchase power from California Electric Co which built the line to the Colorado River on the California side. Public Service tied in and carried on across the river.

Electric power is now replacing diesel engines in operation of the valley's irrigation pumps.

FERRY HELPS STRING LINE TO RICH VALLEY LAND

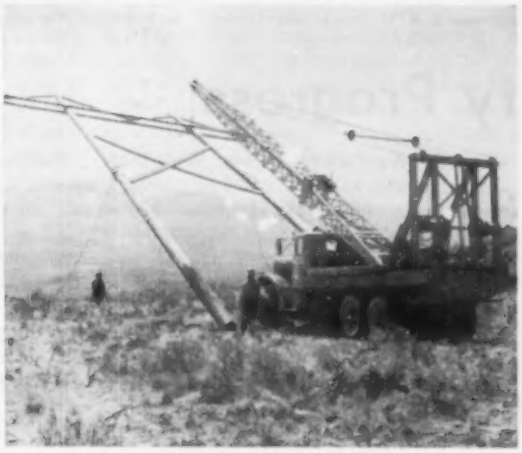
Idaho Power Speeds Tie Line

Idaho Power Co, hoping to complete its new tie with the Northwest Power Pool by February, has put 90 men and big equipment to work on the 50-mi, 230-kv line.

The new line, in Oregon between Baker and LaGrande, will provide for the exchange of surplus power between the utility and Bonneville Power Administration (EW, April 11, p 18). Another existing and longer tie runs through eastern Idaho and Montana.

The 65-ft pole structures were first framed on the ground and then hoisted into the holes by a boom truck (left). To expedite construction, air tampers were used. At bottom left, the equipment aids in setting one of the structures that will carry the heavy conductor.

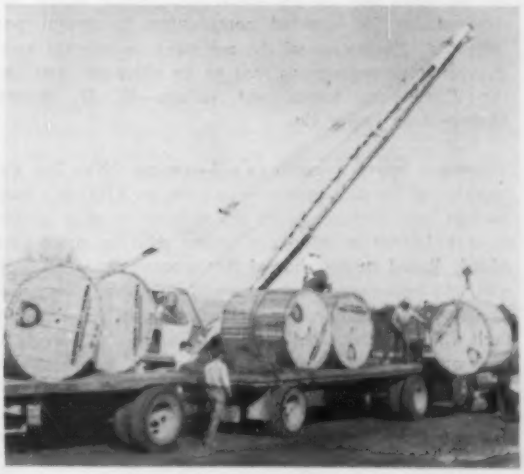
A Bantan crane (below right) was employed at Haines to unload reels of the 795-mcm ACSR conductor, reportedly the largest conductor on any company transmission line.



BOOM TRUCK RAISES POLES FOR IDAHO POWER

AIR TAMPER SETS STRUCTURE FOR CONDUCTOR

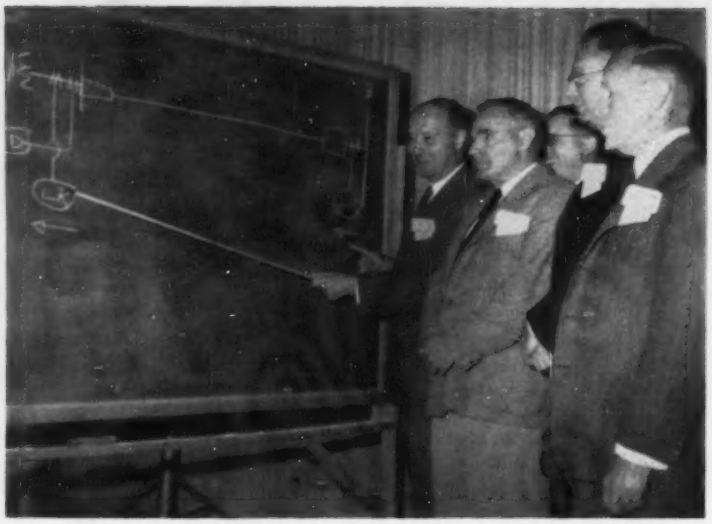
BANTAN CRANE UNLOADS HEAVY CONDUCTOR REELS



ENGINEERING MEETING

At Committee Meetings Devoted to

- System Planning
- Relays
- Systems Operation
- Electrical Equipment . . .



RELAY AIM is to recognize at Point B whether fault is beyond end of line section, explains I. D. Perry, Public Service E&G, backed by colleagues H. P. Sleeper and W. H. Van Zee, to Chairman J. A. G. Oewel (Relay) and J. A. Thielman (Planning)

PEA Promotes Utility Progress

System Planning and Relay Committees
Pocono Manor, Oct. 31

The extent to which planning and relaying are mutually dependent in system engineering today stood out sharply in papers presented at the joint meeting of Pennsylvania Electric Association's System Planning and Relay Committees.

Tapping a transmission line to supply new distribution facilities usually offers economy in first cost or in operation. But selection of this method in preference to others must be guided by assurance that it will utilize available line capacity without creating an uneconomic barrier to full use of the line in future system growth. Reliability of the tapped line must be adequate to serve the new load, and the tap must not cut the line's performance below that required for its intended contribution to system performance. Evaluation of the tap must include the relay changes it necessitates as well as its effect on watt and var distribution, losses and voltage—**R. D. Brown, Monongahela Power Co.**

Tapping a fourth terminal to a 3-terminal 69-kv line was accepted as the economic way to serve an 8,000-kva load. Savings over alternate plans less difficult to relay ranged from $115,000 to $205,000 before relaying costs were added. Board studies showed that a combination of pilot-wire and impedance relaying would give satisfactory protection. This combination cleared properly for the only fault which has occurred during four months of operation. Subsequent developments will convert this tap to 138-kv operation, loop it through a new generating station, and extend it to another 138-kv source; it will thus revert to conventional 2-terminal protection—**J. M. Arthur, Duquesne Light Co.**

Omitting circuit breakers always saves money. They are strictly insurance, and the cost is too high when it approaches the value of the equipment they protect. Experience shows that distribution substations supplied by a single subtransmission circuit have a permanent interruption every 1½ years. Installation of circuit breakers to achieve automatic throwover cuts outages to one in 8 years. Performance figures like these, coupled with recognition of the consequences of failure, guide evaluation of how many breakers can be eliminated—**J. L. Davidson, Long Island Lighting Co.**

Eliminating a 138-kv oil circuit breaker can save upwards of $90,000. Protection by use of carrier to trip remote circuit breakers permits starting a new major substation by tapping a single bank on a through transmission line. The second bank is added with only one high side breaker, retaining carrier tripping to clear remote line ends. Frequency shift has proved the most satisfactory signal for the carrier links—**H. P. Sleeper and W. H. Van Zee, Public Service Electric & Gas Co.**

Relay engineers still look with scepticism on a transformer tapped without a circuit breaker to a 132-kv line. But growth of large industrial loads distant from major substations has forced this practice. Protection generally depends on carrier supervision of directional overcurrent relays. And disturbances to the transmission system have been few during 15 years of practice—**W. A. Richter, West Penn Power Co.**

Too much protection is as bad as too little. The final solution must be a compromise reflecting cost, operating practices, previous experience, and the indications of trouble which are available. Local generation at the tap station

of a 3-terminal line imposes additional complications. Adequate protection usually requires pilot protection using wire links, microwave, or carrier. But where immediate reclosing is not required, sequential tripping often can be applied—**J. L. Blackburn, Westinghouse Electric Corp.**

System stability is a key aspect of service reliability which planning and relay engineers must solve. System growth may create critical conditions at locations which were entirely safe at lighter loading. Protection against such changes is provided by use of high-speed clearing for the transmission backbone. Line applications depend on carrier links while terminal equipment can be protected with high-speed differential relaying. Best clearing times then can be 4 cycles with 3-cycle breakers and electronic relays. Settings must permit maximum emergency transfer without sacrificing fault clearing. And it may not be possible to provide back-up which will also maintain stability—**L. F. Kennedy, General Electric Co.**

System separations from other causes must also be considered. They may occur because of a breaker operation during a stable swing or cascading of relays after a swing has reached its limit. Applying a second shock by automatically reclosing on a fault can sometimes push a system swing into instability. Cure for separations must be provided by system engineering because corrective steps must be applied within one to 10 sec. Instantaneous switching of generating station bus ties can sometimes check a swing before it reaches the stability limit—**C. A. MacArthur, Pennsylvania Power & Light Co.**

System reliability records have real value in planning expenditures for reinforcement—**D. C. Vaughan, Potomac Electric Power Co.** Specific circuit records accomplish more than averages—**C. E. Nelson, Philadelphia Electric Co.** The opportunity to start fresh and build records geared to their intended use is a great advantage. Where reserves have been authorized for major storm repairs, records are essential—**F. T. Hausle, Long Island Lighting Co.**

Automatic feeder sectionalizers split the circuit after predetermined outage and close after sequential delay to spread pickup demands. A trial installation on a circuit has two installations set to pick up their respective sections 3 and 5 min. after the main circuit is energized by the substation breaker. Experience indicates that delays can be reduced, but low voltage up to 48 sec after each section is restored may set application limit—**W. U. Baum, Pennsylvania Power & Light Co.**

Shunt capacitors installed in sidewalks in simple 2½ x 5 x 3-ft vaults provide ckvar support for the low-voltage network. Installed cost is about $20 per ckvar. Similar installation of primary capacitors at the base of line poles costs $10 per ckvar—**C. E. Nelson, Philadelphia Electric Co.**

Indication of the useful life of a power station was revealed by recent economic analyses. This station, started shortly after 1900, was a major power source until 1928 with 116-Mw capability. Since then, except for war years, it has provided peaking capacity. But its fifty-five 1.5 to 2.5-Mw boilers are 40 to 52 years old, and its incremental fuel rate is four times that of modern stations. With a costly major overhaul required to extend life beyond 1959, substantial savings will ensue from shutting it down as soon as new capacity can pick up its remaining load—**W. G. Dempler, Duquesne Light Co.**

CLEARING BUS-TIE TRANSFORMER can limit extent of system separation after a swing, C. A. MacArthur, Pennsylvania P&L Co, points out to L. F. Kennedy, General Electric Co

Systems Operation Committee Harrisburg, Oct. 20-21

System operators are not machines. Their initiative and judgment affect many millions of system investment and service to many customers. Selections of candidates for these jobs is difficult. But research techniques were applied to analyze the ability, likes, temperments, and progress of experienced load dispatchers and system operators. Tests developed from these studies have been applied since 1951 to help West Penn Power Co select candidates—**Dr J. R. Porter, Psychological Service of Pittsburgh.**

Interconnected Systems now dispatches generation which peaked at over 37 million kw in 1954 and involves participation by 100 utilities. Regulation requirements are 408 Mw per 0.1 cycle deviation, and ties are not opened unless frequency drops below 59.90 cps. A gradual drop in frequency must be corrected by members operating with deficient generation, and the correction rate is 0.2 cps to maintain clocks within 3 sec of correct time. Frequency deviations over 0.1% have been very rare since 1953—**A. L. Richmond, Ohio Edison Co.**

Loads have already exceeded 1954 peaks for 15 utilities of 26 reporting. Total load served by this group is expected to reach 25.8 million kw this year, up from 24.1 million last year. Their service area extends from Virginia to Ontario and Quebec—**H. B. Wood, Duquesne Light Co.**

Maintenance outages of generating facilities, particularly units which produce at low cost, must be scheduled in

(*Continued on page* 162)

Industrialists scan proposed route to study potential of 58 plant sites . . .

Kentucky Goes A'courtin' Industry

MANAGEMENT
Area Development

Utilities, Chambers of Commerce, State, railroads, cooperate in joint venture to bring new firms into the blue grass country

A novel combination of Southern hospitality and business hustle this month accented the welcome Kentucky is extending to new industry. The Kentucky Chamber of Commerce in cooperation with the state's Agricultural and Industrial Development Board and a number of utilities and railroads rolled out the carpet for a party of out-of-state industrial representatives.

'Sitefari' Lasted Three Days

The industrialists were taken on an extensive tour of potential industrial sites. The well-organized "sitefari" of the Northeastern part of the state lasted three days and covered 600 miles. It included 22 towns, starting off from Ashland, working down and back up to Covington, and the group was shown 58 industrial sites ranging in sizes from 5 acres to 1,380 acres.

Sponsors of the all-expense-paid tour were the following:

Kentucky Chamber of Commerce; Kentucky Agricultural and Industrial Development Board; Kentucky Power Co; Kentucky Utilities Co; Union Light, Heat & Power Co; Texas Gas Transmission Corp; Western Kentucky Gas Co; Chesapeake & Ohio Railway; Louisville & Nashville Railroad; Illinois Central Railroad; and Southern Railway System.

The party consisted of 12 representatives of manufacturers and consulting firms whose business it is to find places for plants to locate. These representatives met at Ashland on the morning of Oct. 31. After a get-acquainted session and a welcoming dinner, they were shown points of interest in the city by representatives of Kentucky Power, the C&O Railroad, and the Ashland Board of Trade.

The following morning the tour began in earnest. In a chartered bus the party was shown industrial sites in the Ashland area after which similar inspections were made in Louisa, Paintsville, Mt. Sterling, Winchester, and Lexington where the party stayed overnight.

Danville Is Stopping Point

The second day of the tour saw the party visiting Richmond, Berea, London, Corbin, Burnside, Somerset, Stanford, Junction City, and Danville at which point the party stayed for the second night.

The last day of tour was through Harrodsburg, Burgin, Lawrenceburg, Frankfort, Carrollton, Warsaw, and Covington. The last town was the point of departure for members of the party.

Industrialists Saw 58 Sites

Although the tour crowded in 22 towns and a total of 58 sites available for industry, the trip was kept flowing smoothly by holding stops to a minimum. Generally, these were only for meals and overnight stays. But as the bus passed through a community which had a site or sites to offer, representatives of that community would board the bus, give a complete description of the area, and distribute literature containing all the factual data a manufacturer might need.

At Carrollton, the welcome for the visitors reached a high point as the bus was met by a brass band and escorted through the town.

The Kentucky Agricultural and Industrial Development Board prepared a comprehensive booklet, complete with detailed topographical maps showing site areas for each one of the 22 towns visited. In addition, the towns themselves prepared detailed brochures with more information on such matters as the availability of labor, tax

. . . on tour of Northeast Kentucky and to learn . . .

rates, raw materials, water resources, population, communications and transportation.

At some points along the tour, representatives of existing industry boarded the bus to tell of their experiences in the region.

More Tours Planned

Two other tours are planned as part of this project. Early next year, probably in March, a group will be taken through Western Kentucky and sometime in the Fall, the third tour will cover Central Kentucky.

And what was the reaction of the industrialists to the tour?

Generally, the visitors agreed that the primary considerations in evaluating a community as a site for building and operating a plant were:

1. Does the community really want the industry?
2. How co-operative are the potential employees of the area?
3. How progressive is the community?

C. P. Quattlebaum of H. K. Ferguson Co, engineering consultants, put it this way: "Industry wants to be wanted. Unless it feels sure of that, an industry believes it can't take a chance on the cooperation it needs from the civic and business segments of the community."

"American industry is looking for communities where it can get a full day's work for a full day's pay," explained Richard Brumfield, president

. . . Kentucky's Selling Points

What are the major factors on which Kentucky is basing its appeal to industry? The state lists these:

1. A firmly established reputation for good labor, for supplying people who are loyal and can do their full share in meeting production schedules.
2. Favorable geographic location.
3. Excellent water, rail, and air transportation facilities.
4. Good fuel and raw material supplies.
5. A statewide desire by communities to work towards meeting the requirements of industry seeking a new home.

In the past six years the state has added 376 new plants employing 62,243 at a total annual payroll of over $180 million. Value of new plant added in this period is close to $2 billion. In 1955 alone, the state has added 44 new industries with an estimated plant investment of $61 million and employing 6,290 at an annual payroll of over $23.5 million. Plant expansion has added another $63 million to plant investment, 2,625 jobs, and $9.8 million to the annual payroll.

Kentucky ranks third in the U. S. in coal production. Its second most important mineral is petroleum of which over 11 million barrels was produced in 1953. Its 1953 natural gas production totaled 71 million mcf, and reserves are calculated to be 20 to 30 years. Gas exploration continues at the rate of 150 to 200 wells a year.

The state has an excellent water supply. The Ohio River along the entire northern boundary, the Mississippi on the west, and several large streams traversing the state, provide abundant water. Ground water is available in good supply in a number of central regions.

Other raw materials available in the state are: High-calcium limestones, fluorspar (the state produces about 80% of total U. S. supply), and high-grade refractory clays.

Ample reserves of electric power are available from the state's electric companies which have interconnections among themselves and with utilities in neighboring states.

W. KEARNS of Westinghouse (coat on arm) and P. Allen (r) of Kentucky Utilities welcome party at Richmond. Kearns told of his firm's experiences in the region

LOADED WITH FACTS about Kentucky industrial sites and other points of interest, members of visiting party board planes to return to their various home offices

of Potter & Brumfield, Princeton, Ind., electrical-relay manufacturer.

With regard to the progressiveness of a community, John Holbrook of American Machine & Foundry, had this to say:

"When an industry locates in a new community, it naturally sends in key personnel to operate the plant. It must know that these important people in its operation are going to be happy living there. That means there must be good schools, good housing, and other features that make the community a good place to live."

Another member of the party was Robert Easterly, Chicago representative of Ebasco Services, Inc, a firm which has had extensive experience in area development surveys and studies.

Easterly was particularly impressed "by the broad general knowledge possessed by the area development personnel of the electric and gas companies." He cited their "alertness in pointing out to the industrialists on the tour that the electric and gas utilities were well prepared to make their services available at the plant sites."

Visitors Impressed

The visitors all seemed to be impressed by what they saw and heard. They also agreed that such tours are of great benefit in attracting industry. "It helped us to make contacts we otherwise might never have been able to make in a far longer time," said one of the industrialists.

The visitors also had this advice to offer the Kentucky communities seeking industry:

1. Investigate industries you are trying to attract just as much as they investigate you. An unstable company or one with a poor outlook or questionable labor practices can do more harm in a community than no industry at all.

2. Many communities might be better off trying to attract several small plants than one large one. The reason is that diversified industry makes for more economic stability in the community.

For their part the state authorities note that many communities are, for the first time, taking a good look at their assets and liabilities—and doing something about it. Sincerity is replacing super-salesmanship; facts are taking the place of half promises. Successful towns are showing industrialists long range plans and positive evidence of local action.

MEETING REPORT

Fusion Process Need not Be Secret

Smyth of Princeton tells NICB atomic group that thermonuclear reactions have no military significance. Experts more optimistic over waste disposal

Controlled thermonuclear (fusion) reactions have no significant military importance and the veil of secrecy surrounding their use should be lifted. H. D. Smyth, Princeton University, expressed this opinion in a session on peace time uses of thermonuclear energy at the Fourth Annual Conference on Atomic Energy in Industry sponsored by the National Industrial Conference Board at New York, Oct. 26-28.

In what was probably the first non-secret session on this subject, Dr Smyth said that although the rewards of success in this field are great, the probability of success is not very great. He said the reaction must take place at extremely high temperatures (millions of degrees); and even if this is feasible in a controlled reaction, there still remains the question of recovering the energy. If the energy can be recovered, there still remains the question as to whether the device making the reaction possible will consume more energy than it generates. And if all these problems can be solved, there still remains the question of how much it will cost.

Controlled Fusion Process Far Away

Dr Smyth was seconded in his opinion by Hans Thirring, Institute for Theoretical Physics, Vienna. After listing some of the advantages of the fusion process for power generation, Dr Thirring said, "It (controlled thermonuclear reaction) does not exist yet, and nobody seems to see a way to make it."

Opinions expressed at the meeting about the fission process, however, were not as pessimistic. Experts seem to be more optimistic about solving the radioactive waste disposal problem, and one speaker, R. D. Maxson, Commonwealth Edison Co and Nuclear Power Group, Inc, felt that significant progress has been made on nuclear power plant technology in the last three or four years. He said that the feasibility of some reactor plants in the form of the reasonably large size successful submarine propulsion units in addition to the performance of some smaller electric generating plants is most encouraging.

Radioactive Waste Problem Solved

The optimism on the radioactive waste disposal problem was expressed by W. A. Bain, Vitro Corp of America, who believes that there are sufficient waste disposal processes already developed, or under development, to provide adequate disposal systems for power reactors for the next 25 years. Industry must now engineer these processes for their use.

The United Kingdom Atomic Energy Authority has been successful in the disposal of radioactive effluent into the Irish Sea at their Windscale chemical processing plant. P. V. Danckwerts of the Authority said that the effluent is discharged as a matter of routine and that the activity in the neighborhood has leveled off at an acceptably low value.

C. A. Mawson, Atomic Energy of Canada, said that at the Chalk River plant, where the soil is mainly sand, neutral wastes containing little or no dissolved salts can be run into pits in the ground where the radioactive material becomes fixed in the soil and has not been moved appreciably after several years leaching by ground water.

Now that nuclear power plants will soon become a reality, one more problem will be added to the burden of utilities venturing into this new field—the problem of operation. Marvin Fox, Brookhaven National Laboratory, said that based on operating experience at the laboratory the following are necessary:

1. Day to day manipulation of control system.
2. Mechanical and electrical maintenance, similar to that necessary in a conventional power plant.
3. Special electronic maintenance and development.
4. Fuel handling.
5. Personnel radiation protection.
6. By-product disposal.
7. Waste disposal.
8. Record keeping.

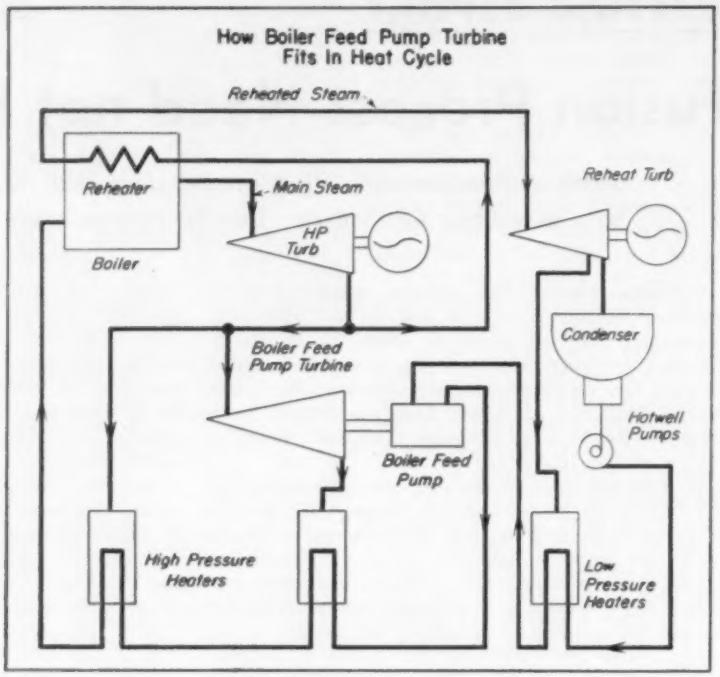
Many of these functions are not required in today's power plants. In elaborating on these requirements, he suggested that the radiation protection staff should be independent of the operating staff so that strict safety is maintained at all times. Record keeping is not new to power plants, but in a reactor plant it takes on added significance because behavior of the reactor is extremely useful in determining long term changes in the reactor characteristics. Because fuel handling will be intermittent and not continuous as in the case of today's plant, it will be difficult to keep a fuel handling crew busy if this is their only duty.

Operators Could Handle Fuel

Dr Fox suggested using the operators for this if union rules permit because they will be idle anyway as the reactor must be shut down at this time (except in the case of a plant designed for continual fuel processing). R. D. Maxson, Commonwealth Edison Co and Nuclear Power Group, Inc. suggested that equipment or fuel element manufacturers may provide this service on a contract basis.

As for the caliber of the operator, Fox said that although a highly trained man is necessary, a highly educated man is not required. There is no room for judgment on the part of the operator. His job is one of strict adherence to a complete set of operating instructions at all times. Situations arise so fast in the control of a reactor that only an automatic means of control can be used.

(Continued on page 154)



Compared with usual motor-driven schemes AG&E finds . . .

Turbine-Driven Feed Pump Best

J. A. **TILLINGHAST**, Staff Engineer, American Gas & Electric Service Corp, New York, N. Y.

Using a full-capacity steam turbine driven boiler feed pump instead of three one-half capacity motor-driven pumps will reduce initial plant investment and improve cycle performance. American Gas & Electric Co has reached these conclusions in design study of generating plants which followed the recent installation of sixteen 215-Mw units utilizing motor-driven pumps. In addition to these improvements, use of a single turbine-driven boiler feed pump has these advantages:

1. For the same main turbine generator rating, plant capability is increased approximately 2% by the elimination of auxiliary power use by the boiler feed pumps.

2. Unit system philosophy of one turbine and one boiler is implemented by use of one boiler feed pump.

3. Variable pump speed for flow control is ideally achieved with a turbine drive.

4. High rotative speed suitable for large capacity, high-head pumps is economically obtainable.

5. HP-heater tube design pressures may be reduced as tubes will not be subjected to the full speed pump shut-off head.

6. Overload capacity is available in a variable speed pump in which the upper speed is not tied to some synchronous speed.

A single, full-capacity turbine-driven pump has several limitations, however, which must be carefully evaluated:

1. Availability of the whole unit, 225-Mw in each of seven units according to present plans, is tied to the availability of the single feed pump and its turbine drive.

2. A motor-driven startup pump must be provided.

3. Operating the pump during start-up requires more control than with motor-driven pumps.

First unit using a single turbine-driven pump is being installed on the AG&E System at the Glen Lyn Plant of Appalachian Electric Power Co. Main turbine is rated 225 Mw with steam conditions of 2,000 psi, 1,050/1,050F. Radiant type pulverized coal fired boiler rated 1,520,000 lb per hr of steam flow at 2,000 psi and 1,050F with reheat of 1,200,000 lb of steam per hr at 1,050F serves the unit. Expected net plant heat rate is 8,920 Btu per net kwhr at 1.24 in. Hg back pressure.

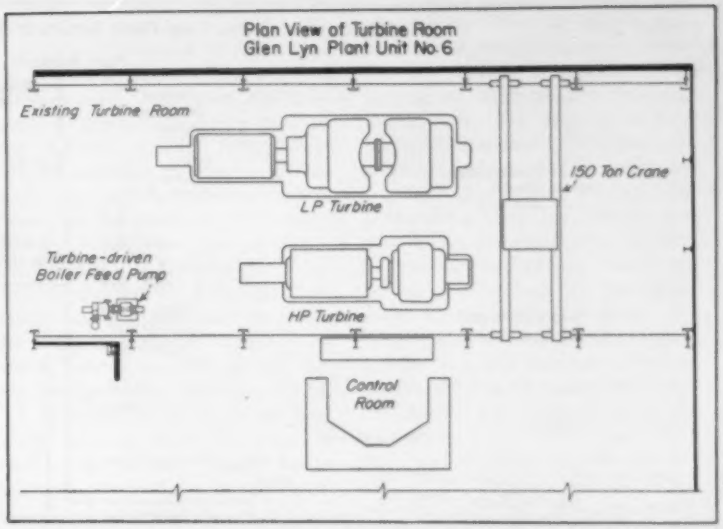
Studies indicated that a single, full-capacity feed pump operating at high speed costs about 25% more than a ½-size pump operating at 3,550 rpm. The steam turbine costs approximately the same as the three induction motors used to drive ½-capacity pumps in the conventional arrangement. Cost of instrumenting and piping up the turbine and providing a small motor-driven startup pump was estimated to be about equal to the cost of the incremental auxiliary power transformer capacity, cable, and switchgear, eliminated when the three drive motors are replaced.

The remaining savings, therefore, amounting to approximately one and three-quarters times the cost of a ½-capacity, 3,550-rpm pump, the elimination of the complex feedwater regulating station, and the reduction in HP-heater tube design pressure, more than equal the increased costs associated with the small increase in main

steam flow which occurs with the use of the boiler feed pump turbine.

More importantly, however, the boiler feed pump turbine reduces investment cost by increasing the plant net output. When operating on a 2,000 psi reheat cycle, the net output of a plant using a turbine-driven boiler feed pump is 2% greater than of a plant using three half-capacity motor-driven pumps. The difference in output is due to elimination of electric power requirements for the boiler feed pump drive. Thus the plant investment per kw with the turbine driven pump is about 2% less than with the motor-driven pump.

The boiler feed pump turbine can be arranged in the main turbine steam cycle to obtain improvement in cycle performance. Throttle steam for the pump turbine is taken from the exhaust of the high-pressure turbine and expanded down to serve high-pressure feedwater heaters. Steam for the highest pressure feedwater heater is taken from the same line that serves the pump turbine.



BOILER FEED PUMP and its steam turbine are both under the 150-ton main turbine-room crane. This arrangement facilitates easy maintenance and inspection

Cycle Efficiency Is Improved

Several factors act to improve the cycle efficiency in this arrangement:

1. Feedwater in the high pressure heaters served by the pump turbine is heated by steam of much lower temperature than that which would otherwise have been available by extraction from the main turbine at the high temperatures immediately following the reheat point. Transferring this heat across smaller temperature gradients between the superheated steam temperature and the feedwater temperature reduces the irreversible heat flow in the cycle and, therefore, according to the second law of thermodynamics, reduces the unavailable energy within the cycle. The highest pressure heater is already receiving steam which has been cooled as much as possible by expansion in the high pressure section of the main turbine.

2. Turbine is directly coupled to the pump so that losses associated with motor drive due to inefficiencies in the main generator, auxiliary power transformer, and drive motors are eliminated.

3. Power is not wasted overcoming pressure drop in a feedwater regulating station or in losses in an hydraulic coupling.

However, reduced internal efficiency of smaller turbines compared with large ones (because of the relative steam volume flow) tends to decrease cycle efficiency. All the steam expanding through the boiler feed pump turbine in this cycle arrangement does so at an internal efficiency somewhat lower than that which could have been achieved in the main turbine.

Heat balance studies show that use of the boiler feed pump turbine to serve three high-pressure feedwater heaters improved the overall cycle performance by a minimum of 20 Btu per net kwhr at full load.

These advantages of reduced cost and improved plant performance must be weighed against the effect of the single pump design on overall availability of the unit as an unscheduled outage on a 225-Mw unit can wipe out the savings indicated in the first cost and in thermal performance.

Availability of Old Pumps High

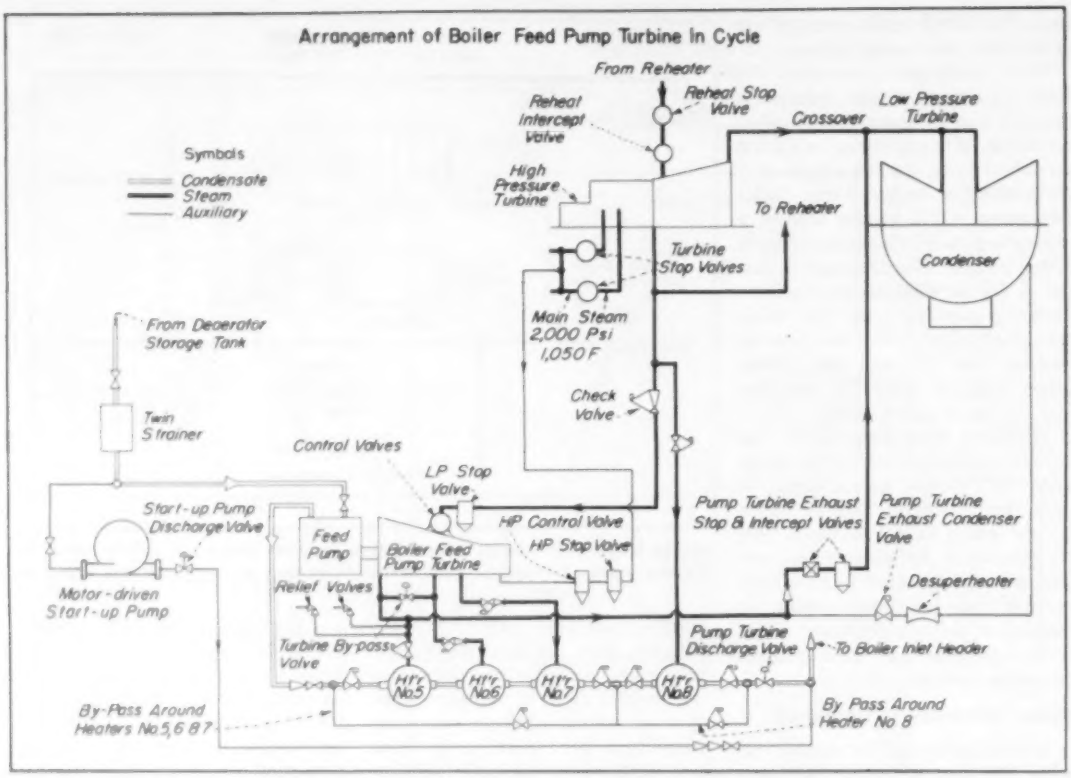
Records of older steam turbine-driven pumps on the AG&E system indicated very good availability. Boiler feed pumps themselves have shown good reliability, and manufacturers' experience with turbine drives of similar size and speed in other fields is very good. Using this combined experience as a basis and having done everything possible in the design of both the pump and the turbine to insure highest availability, it is believed that this arrangement will have better reliability than the main turbine generator or boiler.

Boiler feed pump is rated 3,200 gpm, 6,000 ft head at 5,500 rpm. It is a four-stage pump with a double-suction first stage which normally receives water from a deaerator at a net positive suction head of not less than 70 ft. Shafts are sealed with packless bushings to eliminate repacking. To reduce outage time to a minimum, a complete spare internal assembly which can quickly be installed in the pump has been provided.

Startup Pump Motor Driven

A small motor-driven startup pump rated 600 gpm at 1,500 ft head is provided for startup as steam is not available at this time. This pump will feed the boiler until low pressure steam is available in adequate quantities to operate the boiler feed pump turbine. Flow from the motor-driven pump is regulated by an air operated discharge valve positioned by the operator.

Instead of using this startup pump, it would have been possible to install a full head one-half capacity pump. Startup could then be made up to full pressure and about half load before the turbine driven-pump would have to be started. Approximately half load could also be carried on the unit if there were an outage of the turbine-driven boiler feed pump. Use of this full-pressure half-sized pump, however, would have increased investment cost substantially. It was felt that the best overall balance between investment and unit availability would be achieved by spending a little more to assure high reliability in the turbine-driven pump.



TURBINE IS RATED 6,230 hp at 5,600 rpm; the pump 3,200 gpm, 6,000 ft at 5,500 rpm. Turbine is controlled by flow rather than by speed as it has a large operating speed range and its steam pressure varies with the load on main unit

The boiler feed pump is driven by a single, high-speed steam turbine rated 6,230 hp, 5,600 rpm at maximum condition. Normal steam supply to this turbine is from the high-pressure exhaust section of the main turbine. Full load steam conditions are about 500 psi and 700F. Two uncontrolled extractions are taken from this turbine. The first at approximately 275 psi at full load, the other at 175 psi. These extractions serve the No. 7 and No. 6 feedwater heaters respectively. Exhaust of the turbine is connected to the No. 5 heater and to a tie line to the crossover between the high and low-pressure sections of the main turbine. At full load tie line pressure is 85 psi.

Tie line is required by load variations on the unit which vary the ratio of the feed pump exhaust steam flow to the steam flow required by the No. 5 heater. At full load the cycle is designed so that the exhaust flow nearly equals the No. 5 heater steam requirements. At less than full load, however, the turbine exhausts more steam than the heater can absorb. The only economical place to dispose of this steam is through the main turbine low-pressure section.

Normal steam flow to this turbine is regulated by a stop valve and bar lift-type set of control valves in the upper half shell. Steam seals on the turbine shaft ends are provided. Steam for these seals is obtained from the steam seal regulator and gland seal leakoff condenser system of the main turbine generator.

Special Warming Line Added

To start this pump turbine and to supply adequate steam when the main turbine is at low load, a separate set of high-pressure first stage nozzles has been introduced into the lower half of the turbine shell. Steam is supplied to these nozzles through separate stop and control valves directly from the main steam lines. This system is designed, therefore, for the full 2,000 psi, 1,050F, conditions of the main cycle. Steam was taken from the main steam lines at the main turbine stop valves rather than from the steam drum or intermediate superheater header of the boiler so that no superheater surface could be bypassed and accidentally burned out during a startup operation. A special warming line in parallel with the main steam lines will assure full temperature steam up to the pump turbine high pressure control valve.

Reliability consistent with sound economics was stressed in the turbine design. A solid forged shaft with integral wheels was used. Extensive instrumentation of bearing temperatures, vibrations, and oil temperatures was used to give the turbine the same degree of remote supervision that the main turbine generator will receive. A turning gear was provided, even though the shaft span is short and steam temperatures mild, to assure the operator that the shaft would be straight and ready to start at all times. A set of spare parts is available including a spare rotor, diaphragms, packings, governor part, valve parts, and other smaller items.

The control mechanism positions both sets of control valves sequentially. First, the 500-psi valves in the

line from the high turbine exhaust are opened; and then if horsepower requirements are not met, the 2,000-psi control valve is opened. A check valve in the 500-psi steam line prevents the back flow of steam from the first stage of the turbine into cold reheat line if pressures should be such as to cause this.

Main Turbine Protected

Pump turbine exhaust stop and intercept valves are required to protect adequately the low pressure section of the main turbine against overspeed. An alternate line is provided in the pump turbine exhaust to dump steam directly to the condenser for startup and for periods when the line to the main turbine is closed off.

The stop and intercept valves are automatically opened by the main turbine governing mechanism when the load on the unit reaches about 20%. As these valves move to the open position. they close the pump turbine exhaust valve to the condenser. This valve is also closed by a condenser low vacuum trip set at 5-in. Hg vacuum to prevent dumping steam into the condenser if vacuum should be lost for any reason. In the event that the pump turbine is run after the condenser valve has been tripped shut, the exhaust steam will be relieved to atmosphere through two safety valves.

Bypassing Offers Flexibility

On the feedwater side the single stream of heaters is bypassed in such a manner that either the highest pressure heater, No. 8 heater, may be taken out, or the next three heaters, No. 5. No. 6, No. 7, may be taken out together. This arrangement requires a minimum of bypassing valves and piping and gives a fairly small change in feedwater temperature to the boiler in either bypass case. If the No. 8 heater is taken out of service. feed temperature drops to the temperature of the No. 7 heater. If heaters No. 7, No. 6 and No. 5 are bypassed. the duty on the No. 8 heater rises so that its terminal temperature difference increases to about 20F.

This bypassing arrangement on the feedwater side, however, requires that a pump turbine bypass valve be included to provide adequate flow through the pump turbine when the heaters No. 7, No. 6 and No. 5 are out of service and not absorbing steam. Whenever these heaters are out of service, this pump turbine bypass valve will be open.

Turbine is governed by flow rather than by speed. Impulse from a typical three-element drum level controller positions the control valve gear on the turbine directly rather than through a speed governor. As the main steam flow meter measures more flow than the feedwater flow meter during a load pick-up on the unit, a Standatrol acts to open the pump turbine control valves immediately regardless of the speed level at which the pump is operating. This type of system seemed best because this turbine must meet two severe conditions:

1. Turbine has a large operating speed range to allow the pump to parallel and take over from the motor driven startup pump at low pressure.

2. Steam pressure to the turbine varies with load on the unit. These conditions would have made it impractical to cut the necessary cams to relate feedwater flow to speed at the different feedwater and steam pressure conditions. A conventional turbine governor has been included in the mechanism, however, but is set to the highest expected speed (5,650 rpm) to act as a pre-emergency governor.

Emergency Protection

In addition, a conventional emergency governor is set at approximately 10% above the pre-emergency governor speed. If the air operating cylinder on the turbine which normally positions the pilot of the hydraulic control mechanism should fail, a motor-operated sychronizing device has been provided to override at the operator's command and position the valves accordingly.

Pump turbine is interlocked with the main unit so that it trips out under all conditions when the main unit trips out. If the operator then wants water for the boiler after a trip-out, he can immediately reset and bring the pump turbine to speed. If vacuum has not been lost, 2,000-psi steam will flow through the special first stage nozzles and through the turbine to the condenser. If the vacuum has been lost, the condenser valve will close; and steam will vent to the atmosphere through relief valves. Failure of the pump turbine thrust bearing is indicated by a newly designed device which trips the whole unit off the line.

During startup, the boiler will be filled and supplied with water by the motor-driven startup pump. This pump has a shut-off discharge pressure of about 700 psi so that the main turbine feed pump must be started before this pressure is reached in the boiler drum. High pressure first stage nozzles have been designed to raise the pump speed above 2,700 rpm when steam pressure of 400 psi or greater is available. As boiler pressure rises during initial firing, the operator may start the turbine pump after the 400-psi level is reached and before the 700-psi shut-off head of the motor driven startup pump is reached. The exhaust valve to the condenser is open, and the stop and intercept valves on the line to the main turbine cross-over are closed. Discharge valve in the feed pump line is also closed. This valve was originally included to provide a variable pressure drop to operate the main steam attemperator but also serves the purpose of shutting off the feed pump during startup.

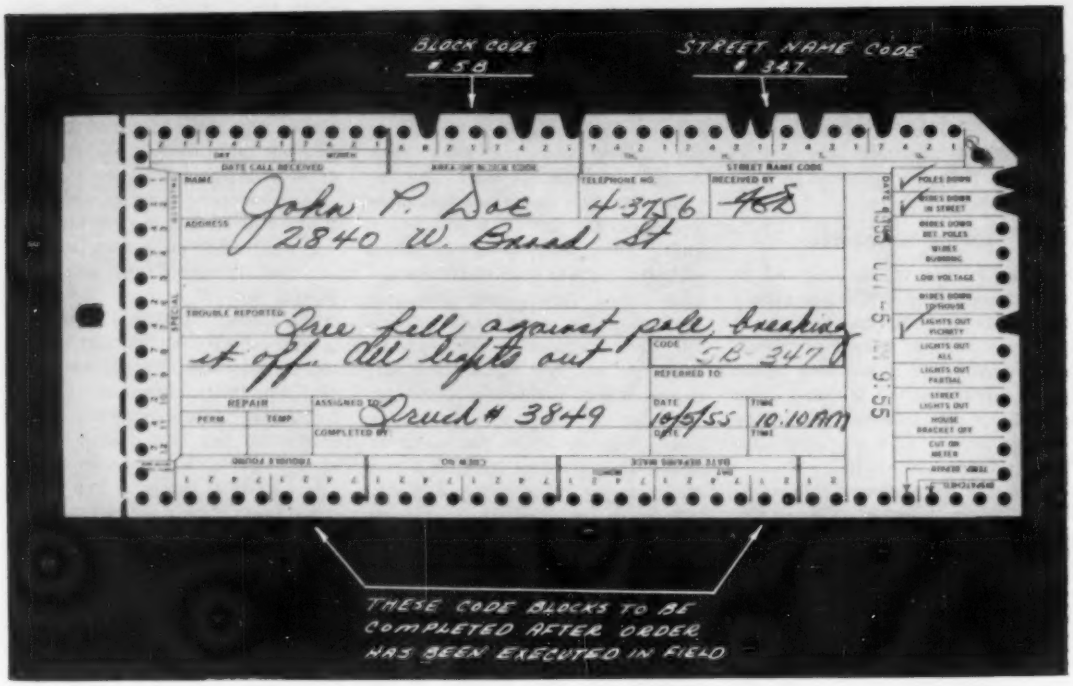
Pump Starting Procedure

The main pump and the motor-driven feed pump cannot be immediately paralled because of critical speed considerations in the pump rotor. These require that the pump not operate in the range of 2,500 rpm. The pump, therefore, is immediately brought to at least 2,700 rpm with the discharge valve closed. Operator then continues to feed water to the boiler as required with the motor-driven discharge valve. When this valve is wide open, he proceeds to open the other discharge valve, allowing the main pump to feed the boiler. This closes the checks in the discharge of the startup pump, and it may be shut down. As soon as the pump turbine discharge valve is wide open, the operator may regulate his boiler feed flow by turbine pump speed.

Operator More Responsible

Operator must manually control the flows and speed of the feed pump as it starts. This is somewhat more of a responsibility than in an installation with motor-driven pumps but is not beyond the operator's ability.

In the event of a trip-out of the unit, the feed pump will come to rest, and an indication of shaft speed lower than turning gear speed will be given the operator. Manually, he will put the pump turbine on turning gear and then be ready at any time to come back in with the pump with rapidity comparable to that of a motor-driven pump installation.



This Special Card for Handling Trouble Calls Is Key to . . .

8-Step Method to Shorten Outages

Use of the method during this year's hurricanes permitted Vepco's Richmond District to restore service 20% quicker. Moreover, it saves time after the cleanup job is done by facilitating tabulation of various types of troubles.

R. L. WALKER, Jr., District Engineer, Virginia Electric & Power Co, Richmond, Va.

A new eight-step method for handling all trouble calls has been adopted by Virginia Electric & Power Co as a result of last years' hurricanes. The simple method is used during the daily routine as well as during storms so that key personnel are fully trained at all times. Nontechnical personnel, needed only during major storms, can be instructed to handle specific jobs in a few minutes because of the method's simplicity.

Use of the method during Hurricanes Connie and Diane cut outage time by an estimated 20% compared with that experienced during Hurricane Hazel using the old method. This shorter outage period results from the more efficient method that requires fewer office personnel but permits quicker handling of orders and checking for duplicate calls. About 95% of the orders issued during this year's storms were for actual jobs requiring attention,

1. Trouble calls are received by the trouble-desk operator and written up in duplicate on a special card-type form.

The special card measures 3¼ x 7½ in. and consists of a white carbon-backed original glued at one end to a buff-colored cardboard duplicate. Space is provided on the front for writing up the complaint and on the back of the duplicate for work done.

Along the four edges of the card are tiny holes each having a designation. Twelve of the holes pertain to 12 types of trouble complaints, while groups of the other holes pertain to such information as dates, area in the district, and trouble found.

2. Cards are sent to a clerk who writes the map block and street code numbers on them to facilitate grouping complaints by areas.

Each map block number designates a specific area, about one square mile, that was derived by dividing the Richmond District in 33 rectangular parts. These are subdivided in two parts, A and B. These divisions and subdivisions were made because 33 two or three-man crews can be organized for medium-size storms and 66 two or three-man crews for major storms.

Within map blocks each street and road is given a street code number that is used to speed checking of duplicate complaints.

Map block and street code numbers are listed in two columns following the street address in a book-type vertical file, which rests on a desk. Some long streets appear on several separate lines in the file because they are in different map blocks.

Use of the file has proved 99% accurate because a quick glance discloses the correct code numbers. Moreover, one man can now do the job that five did when reference was made to maps for determining code numbers.

3. Cards are sent to a keyboard punching machine operator who punches out the code numbers and the date the complaint was received.

The punching machine produces a slot from the appropriate tiny hole to the edge of the card that facilitates mechanical sorting. When a long needle is run through a particular hole in the deck of cards and shaken, the cards having a slot drop out of the deck, onto a desk.

This mechanical sorting system is relatively inexpensive and very flexible. The machine rents for $20 a month. And the system can be operated quickly and accurately by clerks after only a few minutes instruction.

4. Cards are sorted either manually or mechanically for either the inside trouble board or the outside trouble board.

The two trouble boards for filing the cards have marked slots for each subdivision of the map blocks. The inside trouble board holds cards for "lights out" complaints on the customers' premises and "lights out" in the vicinity. The outside trouble board pertains to actual trouble to the company's distribution plant. This separation is made because restoration of a circuit usually clears up the "lights out" complaints without a serviceman investigating.

5. Cards are hand sorted for map blocks and placed in the appropriate slots in the two trouble boards.

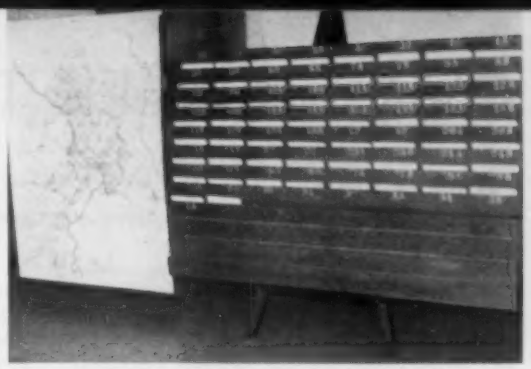
As the storm progresses, a glance at the number of cards in the different slots reveals the areas in the district that are hit hardest.

6. Cards are sorted mechanically in each map block for duplicate calls.

The needle is used to sort out cards having the same street code number. By comparing the trouble listed on the cards for each street, duplicate cards can be weeded out and destroyed. Also, having cards grouped by streets permits quicker dispatching of work and eliminates excessive travelling for crews.

7. Cards are then dispatched to the trouble crews.

Carbon duplicates of the trouble cards are given to the servicemen by map blocks, and originals are left in the slots of the trouble board. Also handed to the servicemen are up-to-date small-scale maps of the map blocks for use in finding streets. If orders are given out by radio or telephone, servicemen fill out blank service orders.



OUTSIDE TROUBLE BOARD has slots for holding the special cards that are sorted according to the map block numbers

Each crew works in one map block until all the trouble has been cleaned up. Then the crew is shifted into another block to assist during the final clean-up period.

As each job is completed the service man writes the work done on the reverse side of the trouble card and then turns it in as soon as possible. When the card is received at the office, the original is pulled from the trouble board.

Sometimes a fuse blows after it has been refused and after the trouble card has been pulled. Then renewed trouble calls come in. These repeat orders are put back in the active file and not sorted as duplicate calls.

Trouble cards in the inside trouble board are usually marked "corrected" when the circuit is restored. They are checked with customers by telephone occasionally during the day. However, this type of trouble may still be reported after circuits are restored. These complaints are usually corrected by restoration of sections of circuits and transformer fuses.

8. After the storm completed cards are tabulated for various statistics with the aid of mechanical sorting.

The carbon-copy of the card is used because it contains the information on the work done. This information is punched into the card according to code numbers established for about 70 types of trouble, such as pole down, transformer fuse blown, burnt up transformer, etc.

When all cards have been punched for the desired information, including the date trouble was corrected, they are mechancially sorted for the records. Thus, in a matter of minutes the total number of troubles of a particular type can be determined.

MAP BLOCK AND STREET CODE numbers are listed in this book-type file following the appropriate street address

Computer Makes Duration Curves

SYSTEM ENGINEERING
Dispatching

Hourly system loads over year can be analyzed and plotted by same punched-card methods used for billing and accounting

C. R. MURTON, Southen Services Inc., Birmingham, Ala.

A load duration curve is a valuable tool to the production and transmission departments of the typical electric utility. It gives the graphic answer to "How long did (or will) a particular load last during the period under study?" It may be used to estimate transmission system losses more accurately, to determine the proper allocation of load between generating plants, and to evaluate the most economical use of hydro generation in combination fuel and hydro systems.

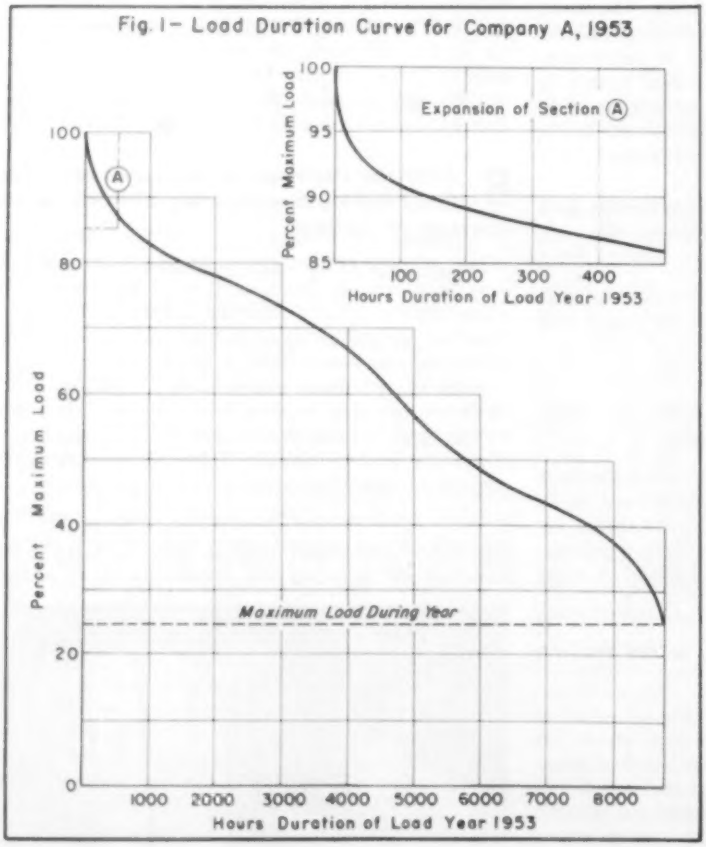
Construction of a load duration curve involves analysis of hourly system loads, and done by hand it is a rather overwhelming statistical job. Some utilities analyze a short period, such as a typical week period (168 hr), plotting percentage of maximum load against percentage of time. Such a curve can be used for monthly or annual periods. At least one company has used such a typical week curve as an estimating tool over a fairly long period.

Many users of load duration curves have discovered, or surmise, that the curve is shifting because of new load increments, such as summer cooling or winter space heating. When the curve is based on a short period, say a typical week in the past, the choice of the typical period for analysis is shadowed with suspicion that it could lead to inaccuracies. A number of utilities have expressed their desire for an inexpensive method of constructing a load duration curve based on an analysis of the calendar year.

Many electric utilities use punched card methods for billing or accounting; so most of them have available the equipment for such an analysis. A statistical analysis of system hourly loads on punched cards is the basis for load duration curves covering all the hours in a year, peak summer month, peak winter month, normal week days, and weekends including holidays.

This article's description of the punched card approach to a load duration curve, such as is shown in Fig 1, is for a hypothetical system of three interconnected companies operating their production systems in a common pool. The equipment needed is a key punch, a card sorter, a reproducer, a calculator such as the IBM Type 604 or 602A, and a tabulator for preparing the results. In place of the key punch, a reproducer equipped to read pencil marks may punch the holes, provided a card form is available for "mark sensing" the required number of positions for hourly loads.

Fig. 1— Load Duration Curve for Company A, 1953



User Finds Own Layout

Card form IBM 5081 is useful when the log sheet is read by a punch operator, and IBM 715526 MS when log sheets are transcribed in pencil for later mechanical punching. In either circumstances data and results are punched in the card in the manner illustrated in Fig 2. Each user, however, will probably find the most suitable layout for his particular problem.

For accurate identification each card should be prepunched in columns 1 to 7. When log sheet data for only one company are to be key punched, the identifying data can be punched at the same time. But when card form IBM 715526 MS is used for hand transcription or when more than one set of log sheets are used, identification must be prepunched.

The first time prepunched identifi-

Fig. 2 - Arrangement of Data and Results on a Punched Card

				Company A			Company B			Company C			System			Critical Periods						X
				Load			Load			Load			Load			Monthly		Weekday		Other		
Year and Month	Date	Hour	Day of Week	In 1/10 MW Units	Ratio to Max Hr	Hours Duration This Load	In 1/10 MW Units	Ratio to Max Hr	Hours Duration This Load	In 1/10 MW Units	Ratio to Max Hr	Hours Duration This Load	In 1/10 MW Units	Ratio to Max Hr	Hours Duration This Load	Ratio to Max Hr	Hours Duration This Load	Ratio to Max Hr	Hours Duration This Load	Ratio to Max Hr	Hours Duration This Load	Calculator Control
2	3	6	8	13	16	20	25	28	32	37	40	44	49	52	56	59	63	66	70	73	74
1	4	5	7	12	15	19	24	27	31	36	39	43	48	51	55	58	62	65	69	72	76	80

cation is required, the procedure is as follows:

1. Prepare 31 cards punched 01 to 31 in columns 3 and 4 (with control X in column 37).

2. Reproduce 11 times to make 12 copies of Date Deck.

3. Prepare 12 cards with digit representing the year (3 for 1953) in column 1 and 1 through 9 (for January through September), O for October, X for November, Y for December in Column 2, and a master card X in some column, such as 38 for Month Deck.

4. Place one card from Month Deck ahead of each set of Date Deck and selectively gang punch columns 1 and 2.

5. Remove by hand dates not needed (columns 2 to 4), ie, 229 to 231, 431, 631, 931, and X31, leaving 365 cards arranged by dates from 101 (Jan. 1) to Y31 (Dec. 31).

6. Make several copies of 7 card deck with 1 through 7 in column 1 for Day of Week Deck. Code: 1 for Monday, 2 to Tuesday, etc, through 7 for Sunday.

7. Lift enough cards from front of Day of Week Deck to leave on top a card coded for the day of the week that Jan. 1 fell on and place lifted cards at back.

8. Continuously reproduce column 1 of Day of Week Deck into column 7 of Date Deck, so that all 365 cards have the proper day of week coded therein.

9. Prepare 25 cards punched in columns 5 and 6, 0 through 24 and 99 (Cards identified as hour 99 will contain the total daily supply for that date. Both the transcription, or key punching, and the addition on log sheets can be checked by adding the hourly loads and subtracting the daily output for each day on a tabulator where a 9 in column 5 is wired to cause subtraction instead of addition.) with X in column 7 for those identified as valley hours.

10. Reproduce these 25 cards 364 times, making 9,125 cards.

11. Before each set of 25 cards, place one card from Date Deck and by the control X in column 37 selectively reproduce columns 1 to 4, digits only for column 7. Wire checking circuit through a column split so as to not pick up X in 7 by punch brushes.

12. If an interpreter is available, the digits punched in columns 1 through 7 may be printed on the top of each card for ease in reading.

Data Updated

When a 9125 card is available from the previous year, the preparation of the prepunched identification is much simpler and as follows:

1. Sort on column 7, separating each day of the week (1 through 7).

2. Normally dates that were Monday (1) last year will be Tuesday (2) this year.

3. Reproduce all cards with 1 in column 7, gang punching new year in column 1, and 2 for Tuesday for column 7 and copying data in columns 2 to 6 into columns 2 to 6 of new deck. Repeat for old Tuesdays, making Wednesday, etc, through entire seven groups.

4. Sort on columns 6, 5, 4, 3, and 2 so that reproduced deck is now in order of dates and hours.

5. This routine must be modified if either the current or previous year is a leap year with a Feb. 29. This modification is evident and not difficult.

Load Given in 1/10 Mw

Following the identification procedure, the next step is to key punch or "mark sense" the log sheet data into or on the card—the correct card as identified by date and hour. With reference to Fig 2, the load for company A is punched into columns 8 to 12. When all log sheets have been transcribed for company A, the process is repeated for company B, etc. Load is recorded in 1/10 Mw because maximum load is more than 1 million kw. If the total daily output is also recorded (as for hour 99) for verification of log-sheet totals, transcription routines that total would be in Mwhr so that the total would not exceed five digits when using this card layout.

When the hourly load is found to be correctly represented in each card, the cards for hour 99 are pulled out by sorting on column 5, pulling 9's only. This leaves 8,760 cards in the Record Deck.

The loads of the three companies on each card are added by the calculator, and the sum is punched in columns 44 to 48. The cards are now ready for preparation of an annual duration curve for the system.

The 8,760 cards are arranged by the sorter in descending order of the values punched in columns 44 to 48, maximum hour for the system for the year being the top card. This card should be further identified by punching a control X in column 77.

Calculator Used

The next step involves use of the calculator, preferably Model 604, which operates at the rate of 100 cards per min. By proper wiring of the control panels, the machine:

1. Stores the load value from the card having an X in column 77,

2. Divides the load value for each card by the value stored to determine the ratio to the maximum of the year (Only the three decimals are punched —in columns 49 to 51 for instance— so the first card will have three 0's in that field, representing the ratio 1.000.

(Continued on page 156)

Transformers and Circuit Breakers

Cost calculations were based on 120 Long Island Lighting Co work orders completed during the years 1939-1953. In general, the following calculating procedure was used to determine the final results:

1. Work order costs were averaged for each year and corrected for inflationary effects.

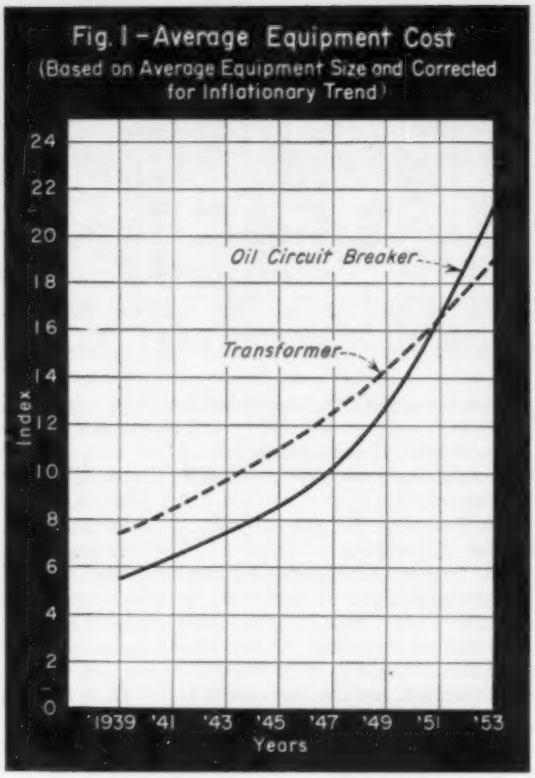
2. The points were plotted on a graph.

3. Smooth curve was made which approximately followed the plotted points.

4. Estimated costs were read from the smooth curve.

The increased cost of installed oil circuit breakers is not quite as serious as the curve tends to suggest. Even though breakers cost much more in 1953 than in 1939, the equipment does a much better job, and protects systems of higher voltage and greater interrupting duties.

Transformer installation costs have been kept low because of the shift from 1-phase to 3-phase banks and because of larger sizes.



COST OF PROTECTING equipment today exceeds cost of protected equipment. Reversal of cost ratio occurred in '51

What Affects Substation Layout?

SUBSTATION Design

Long Island Lighting Co has found that equipment costs and the fault free performance of transformers are important factors

J. L. DAVIDSON, Electric Planning Engineer, and
A. J. PANSINI, Manager, Line Construction and Maintenance, Long Island Lighting Co. Hicksville, N. Y.

As a result of a recent study on protection for distribution substations, Long Island Lighting Co has reached the following conclusions about breaker requirements for stations where high service reliability is a requirement. An economic method of providing protection is a single breaker arrangement with ultimate development into a 3-breaker arrangement should future load demands require it.

Two main factors influencing this statement are:

1. Current relative increases in cost of installed power circuit breakers as compared to power transformers.

2. Experience records showing the relative susceptibility to faults of the various components of the system for which protection is needed.

Fig 1 shows that the average oil circuit breaker cost in 1939 was approximately 75% of the cost of the average transformer while in 1953 the average oil circuit breaker cost was 13% greater than the transformer cost.

Several significant facts can be noted from these curves:

1. Average transformer material and installation costs per Mva are relatively constant through the years when corrected for inflationary trend. This has resulted from the use of larger, 3-phase banks.

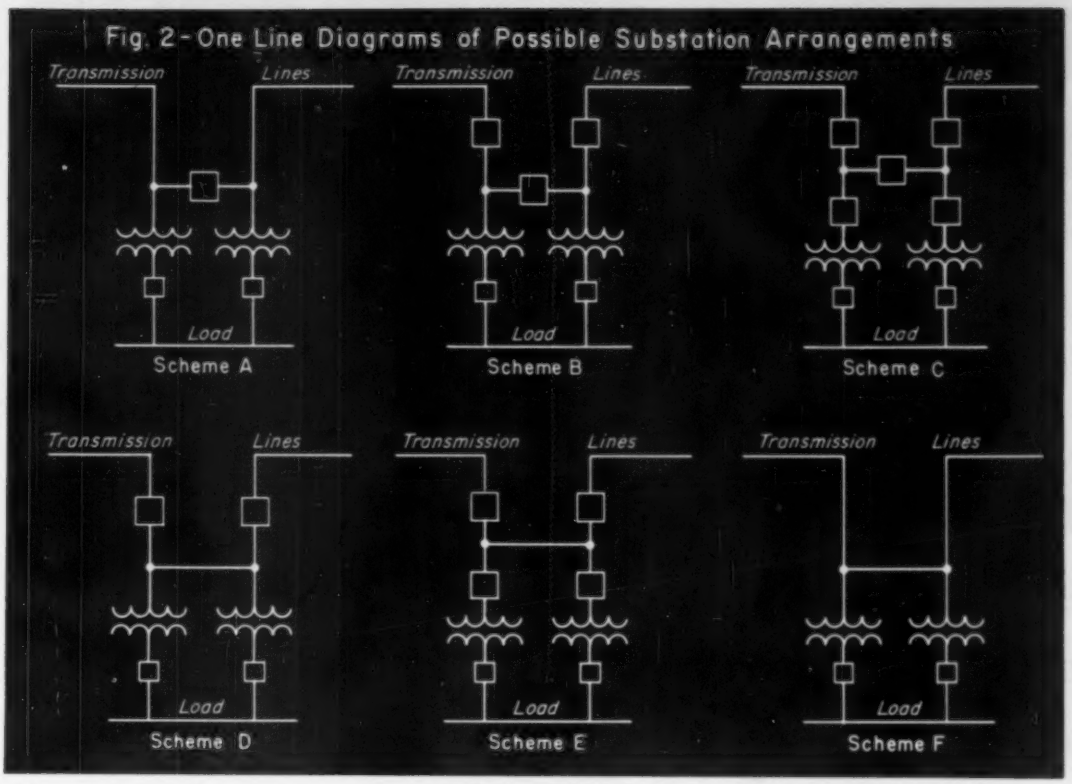
2. Installation costs of oil circuit breakers, which include relays and control facilities, have risen sharply. Higher voltages, higher interrupting duties and improved housing for control panels have caused the rise.

Operating records during the last 10 years show that permanent faults occurring on the Long Island Lighting system can be classified as follows:

- Transmission line faults 83%.
- High voltage bus faults 13%.
- Transformer and associated transformer busses 4%.

If momentary transient faults on the transmission system are included, the above values become 94, 4.5, and 1.5%.

Or expressing it another way, average length transmission lines will develop a permanent fault in from



APPLYING THE tests of installed cost of protecting equipment vs the need for such protection indicates that the one-breaker Scheme A provides economic and adequate protection. But Scheme B provides more emergency capacity

one to three years, the average high voltage bus will have a fault once in 11 years, and the average transformer zone fault will occur once in 55 years.

Fig 2 shows several possible breaker arrangements. Schemes A, B, and C protect the load against single circuit high side failures. In these schemes, the load is not dropped even momentarily. For situations where infrequent load interruptions from bus faults may be tolerated, schemes D and E may be used. Scheme F, with no high-voltage breakers, subjects the load to transmission line faults.

One-Breaker Plan Favored

Assuming that no service interruptions can be tolerated, comparison of these schemes in light of the statistical facts mentioned above, namely high breaker installation costs and small occurrence of transformer faults, favors the one-breaker arrangement with conversion to three breakers when contingency requirements necessitate that more transformer capacity remain in service during transmission line fault conditions. However, a grounding device, which applies a ground on the high side of the transformer bank, may be necessary to insure operation of the remote feeder breakers in those cases where a fault on the low side of the transformer does not produce sufficient fault current for proper breaker operation.

Scheme A is adequate for the initial stage in development of a firm distribution substation. It provides transmission line fault protection and allows one transformer bank to remain in service for a fault on one of the lines. The firm capacity of this station, however, is limited by the emergency rating of one bank.

Five substations of this type have been in operation for several years and have given satisfactory operation; two of these have been installed in the past few years and others are planned for future operation.

Should more contingency capability be required, the arrangement can be converted to Scheme B (3-breaker arrangement). This plan allows both banks to remain in service under fault conditions on one of the lines and provides improved protection for the transformers.

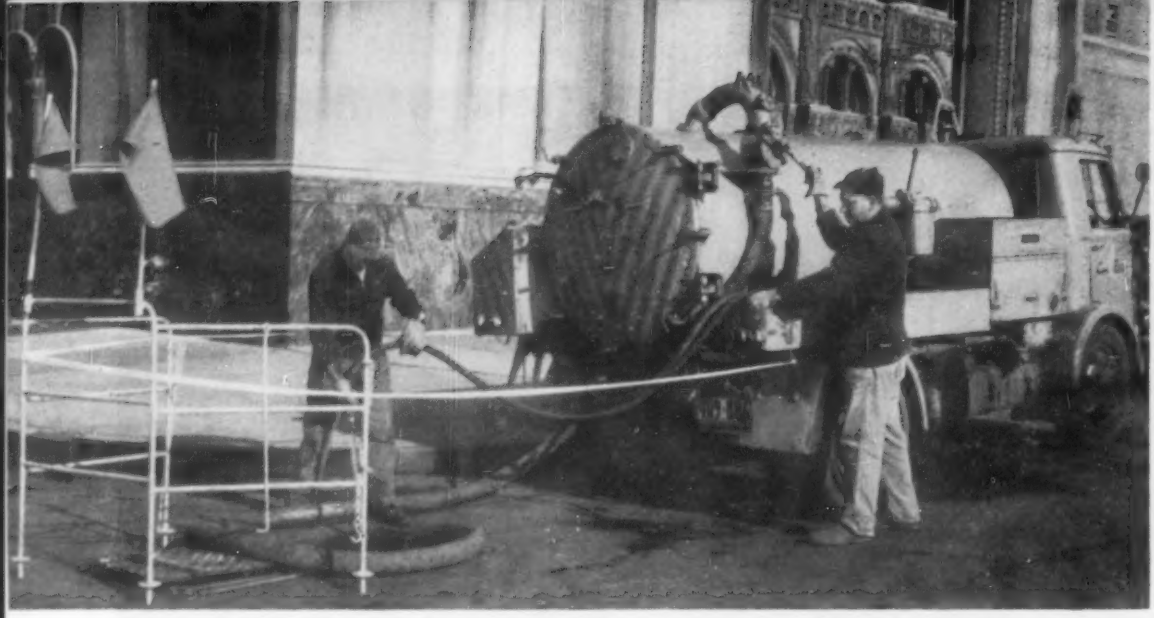
In Scheme C, the primary purpose of the two additional transformer breakers is to maintain the transmission line intact during transformer zone faults. However, the low frequency of this type fault (once every 55 years) makes it difficult to justify the additional expense. Protection of the transformer as such is no greater than in Scheme B.

Space Layout Is the Same

Comparing the merits of Schemes A & B shows that the initial cost of B must include the cost of three breakers vs one for A. However, A requires more extensive relaying. Engineering design costs for the 3-breaker scheme will be slightly higher. The space layout of the station is the same for both schemes. The 3-breaker plan permits both transformer and bus differential relaying, as opposed to the grounding switches required in the single breaker scheme.

Maintenance cost of Scheme A

(*Continued on page* 157)



DISTRIBUTION—Maintenance

EEI Handbook Survey Shows . . .

How Underground Is Maintained

C. S. ANDERSON, Associate Chapter Editor, EEI Underground Systems Reference Book, Pacific Gas & Electric Co, San Francisco, Calif.

This survey describes the current state of underground system maintenance and repair and the equipment and materials for this purpose. It also reflects the thinking of engineers with many years of underground operating experience. It is based on the practices of 12 utility companies, coastal and inland, which operate some of the largest underground systems in the country. Data were compiled by the author for Chapter 12, "Maintenance and Repair," of the "EEI Underground Systems Reference Book."

The survey shows opinion divided among engineers on underground water problems. Some accept an occasional wetting of manholes, others a dry system as the norm. Main provisions for keeping a system dry are waterproofing, sealing, and sewer drains. Very few companies seal off manholes or main duct lines.

Generally, the preference is for P-traps, check traps being installed only when necessary. Most utilities make limited use of sump pumps, particularly in manholes housing major equipment. Electric motor maintenance seems to be the limiting factor. Prevalent practice has work crews pumping out manholes to enter them, although three companies pump them out at intervals of from eight months to five years. Centrifugal pumps, mostly truck-mounted or portable, are favored. Diaphragm pumps are used for moving mud or other thick fluids or where continual priming may be necessary.

Most of the 40% of companies sealing main ducts prefer duct seal, but cement, oakum, and sand-cement also have their users. Other sealing materials in use are a plastic cup and waterproofing compound. Almost all companies seal services in buildings, using duct seal and water plug. Seals on duct lines and services are inspected and repaired generally on the basis of reports of gas or water in stations or buildings. Seals also aid in rat control.

Manhole cleaning practices vary. Those under sidewalks may be cleaned monthly, once every five years, or as

EEI Underground Handbook Series Scheduled

This is the first of a series of articles dealing with underground system design and operating practices based on material collected for use in the Edison Electric Institute's Underground Systems Handbook. Publication of the handbook, expected the first quarter of 1956, is an activity of the EEI Transmission and Distribution Committee under direction of Editor-in-Chief J. A. Pulsford, Public Service Electric & Gas Co. The second article, to appear in December, will report the residential underground system practices of 30 utilities.

required for inspection or work. Monthly schedules are reported most frequently. This pattern pertains also to manholes in the street, except that cleaning is less frequent. Other manholes and handholes are cleaned prior to work being performed in them. Manual cleaning is the general rule although effective use is sometimes made of a tank truck equipped with a pump and ejector. Such units remove sludge, small trash, and mud.

Minor Cracks Disregarded

While most companies disregard minor cracks in manholes, about half of them view major cracks seriously, especially in older manholes. Apparently most manhole damage is caused by water from city systems or by improper shoring by other agencies.

Companies vary in their attitudes towards duct line breaks. But while all report working on such damage with cables energized, only some take steps to protect cables from mechanical injury during the work. Water line or sewer leaks and damage caused by adjacent work by other agencies are main reasons given for breaks.

While inspection of bonds and grounds varies in frequency from company to company, most pay close attention to bonds on cables near stations. Some engineers feel that bonds need checking only when cables are being spliced or when faults in manholes are being located. Generally faulty bonds are repaired by soldering or replaced.

The companies disclose a wide range of thinking on the replacement of bonds on energized cables. One places no restriction on the maximum voltage, another requires that the line be killed, and the remainder allow replacement on energized cables ranging from 240 v up to 34 kv.

Sheath Inspections Vary

Lead sheath inspection practices also vary considerably. Cables operating under severe load cycles are inspected semi-annually by some companies and up to five years by others. Most companies inspect only transmission or heavily cycled cables.

In repairing a crack or break in a lead sheath near the wipe, the most common practice is to patch or lead burn. Otherwise a splice is made and a longer sleeve is used. In making repairs at the bend of a cable or at the duct mouth, most companies first try burning. But several use a skin-tight sleeve or a special neoprene tape and an oil-insoluble adhesive at the bend. Tape, however, may allow discontinuities in the sheath and make fault location by tracer method very difficult.

PACIFIC G&E OIL DISCOLORATION CHECK IS MADE WITH LINES "HOT"

When simple patching is impracticable at the duct mouth, some companies chip the duct back or pull the cable ahead to forestall the cost of pulling in a new cable. Most companies allow repairs on energized cable only up to 600 v, but a few up to 2.4 kv.

Most Fireproof Cables

Restrictions on moving or bending energized cables up to 25-kv range from no moving or bending through bending in good condition only. One company, however, observes on the basis of results of bending tests on energized cables: "It is perfectly safe to move live cables in the manholes, provided the sheath is not broken, cracked, or damaged to the extent that moisture may have entered the insulation."

Most companies fireproof cables, more than half of them using a protective coating on the cable. Generally fireproofing is applied to cables above 600 v, and felted asbestos and silicate of soda are preferred. Some utilities use niagrite with asbestoment and asbestos roving. One company prefers dry glass tape applied half lapped, and another amorphous wax.

Complete replacement appears to be the general practice in making repairs on collapsed joints although four companies pump up the sleeve in an effort to avoid it. Most companies drain gas-filled joints at least twice during the first year of installation and annually thereafter. One does it bi-monthly the first year.

First-year drainings may appear more frequent than necessary, and usually the number depends upon the manufacturer of the cable and the type of loading cycle. Oil clogging of solid tubes is overcome by blowing the tubes with pressurized gas, one company using 40-psi nitrogen. One company uses a solvent before blowing down to remove all oil completely.

Live Repairs Limited

Most companies do touch-up brush painting on transformers in vaults, one steam-cleaning with a detergent preparatory to painting. Many utilities pressure-test transformer tanks and seals for water tightness before the first installation. Test pressures are under 10 psi. Some utilities test installed transformers periodically. Two do not test.

Although most companies permit changing of oil, most utilities limit repairs on energized transformers to external connections and gasket adjustments. Overloads and failures are the two main causes listed for removal of transformers. One company gives rusty tanks as a major reason for removal.

Maintenance of auxiliary equipment in vaults consists of replacement and cleaning and, in the case of one utility, of replating contracts.

Underground Maintenance and Repair Practices of 11 Companies

	Boston Edison	Con Ed of N Y	Company X	Potomac El Pwr	Rochester G&E	Cleveland El Illum	Cincinnati G&E	Kansas City P&L	Union El Co	Dallas P&L	Northern States Pwr
I—WATER PROBLEMS											
Normal condition of underground system	Occ wet	Dry	Occ wet	Occ wet	Dry	Occ wet	Dry	Occ wet	Dry	Occ wet	Dry
Reasons: Dry	Low wtr tbl, avg rain	Sewer drain		Sewer drain, lttl rain	Sewer drain	Sewer drain	Sewer drain	Wtrprf, seal, low wtr tbl	Sewer drain	Sewer drain low wtr tbl mod rain	Low wtr tbl no rain
Wet	Tidal	Tidal, hi wtr tbl, hvy rain	Tidal, hi wtr tbl	Tidal, hi wtr tbl		Hi wtr tbl			Hi wtr tbl, hvy rain		
Methods used to											
Seal leaky manholes								Seal'g cmpd		None	
Seal ducts	Duct plugs				Duct seal				Duct seal, (1) sand-cement	None	
Stop pressure leaks								Sealing cmpd	Spec plates (2)	Quick set cement-sand	
Type trap valves	None	None		P	P, BW	P	P	BW	P, b'k-press.	BW	
Maintenance				As needed	Occ	Prac none	Occ	Very little	Inoper trap	Occ	
Type sump pump	Elec	Elec	Elec	Elec	Elec	Elec	Elec		Elec	None	
Where used	Mjr equpmt			Mjr equpmt	High sewer	Netw'k vault	No drain		Mjr equpmt (3)		
Maintenance			6 mo	Routine					Motor burn-out		
Routine pumping	Ev 5 yrs			None		None	None	Yearly	None	Ev 8 mo (4)	
Non-routine pumping after rains, floods	For work only	For work only	For work only	For work only		For work only	For work only	For work only	For work only	No vaults that flood	
Type pumps											
Injector	Trk	Trk									
Centrifugal	Trk, port	Trk, trlr port	Trk	Port		Trk, port	Port	Trk, port	Trk, port	Trk, port	
Diaphragm	Trlr, port	Trk, port									
Seals for ducts	Duct seal, plugs	(5) Oakum duct seal	Duct seal Condu-seal	None		None	Cement	Duct seal	None	None	
Maintenance	Wtr, gas in station	As needed	Min				Prac none	Routine			
Services sealed at buildings	Duct seal	Oakum duct seal	Duct seal Condu-seal	Duct seal		Duct seal cement	Duct seal plug	Duct seal	Duct seal (6) sand-cement	Duct seal	
Maintenance	Wtr, gas in bldg	As required	As required	None		As required	Occ	Routine	Very little	Insp yearly, repr as nec'd	

	Boston Edison	Con Ed of N Y	Company X	Potomac El Pwr	Rochester G&E	Cleveland El Illum	Cincinnati G&E	Kansas City P&L	Union El Co	Dallas P&L	Northern States Pwr
II—CLEANING PROBLEMS											
Cleaning cycle for											
Vented manholes											
Street	Every 5 yrs	As required	Infrequent	Twice year (7)	Twice year	Monthly	As required	Ev 6 mo	As required	About	Monthly
Sidewalk	Every 5 yrs	As required	Up to 3 times year	Twice year (7)	Yearly	Occ	Monthly	.....	As required	ev 2 wks	As needed
Other manholes	Every 5 yrs	As required	For work only	For work only	As needed	Occ	Yearly	Ev 6 mo	For work only	None	As needed
Cleaning method	Manual pump, ejector trk	Manhole wash trk	Manual	Manual	Manual	Vacuum cleaner (8)	Manual	Manual	Manual	Manual	.....
III—STRUCTURES											
Repair minor cracks	No	Caulk	No	No	No	No	Cement	No	No	Caulk	No
Serious problem of											
Major cracks, settlements	No	No	No	No	No	No	Yes	No	Yes	Rebuild	No
Duct line breaks	Occ	No	No	No	No	No	No	No	No	Repair	No
Repair, rebuild with cables energized	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IV—CABLES IN MANHOLES											
Bonds and grounds											
How often checked	Yearly (9)	Yearly (10)	With other work	Trans semi-annual, or with other work	As required	During electrolysis surveys	Low voltage year, 66 kv month	Every 6 mo	Every 6 mo	Every 8 mo	Yearly
How repaired	New bond	Solder	Solder	Solder	Solder	.....	Solder, serve-wipe	Solder	Wipe new bond	Solder	Solder, connector
Cables energized, max voltage	Yes 25 kv	Yes 27 kv	Yes None	Yes 13.2 kv	Yes 34 kv	No	Yes 480 v	Yes 13.2 kv	Yes 34.5 kv	Yes 2.4 kv	Yes 240 v
Lead sheaths											
How often checked	Yearly, severe cycling	Yearly (10)	Periodic	Trans, 6 mo or with other work	With other work	In case of trouble	With other work	Every 6 mo	Periodic	Every 8 mo	Yearly
Repairing cracks and breaks											
Near wipe	Patch, use longer sleeve	Long sleeve, skin-tight over cable	Wipe knob, overlength splice	Longer wipe	Solder patch	Solder	Long sleeve or wipe	Solder wipe	Solder wipe	Solder	Use longer sleeve

(1) Services into buildings only. (2) Through levee, special plates with rubber gaskets sealing against copper tube wiped to lead sheath. (3) Pump used only where no sewer is available. (4) Wet locations may be pumped weekly. (5) Services only. (6) Services also sealed at manhole or service box. (7) For network transformer manholes only; others as required. (8) For network vaults. (9) When tied to other systems; otherwise only when splicing or locating fault. (10) General station areas; other, every five years.

Underground Maintenance and Repair Practices of 11 Companies – Cont.

	Boston Edison	Con Ed of N Y	Company X	Potomac El Pwr	Rochester G&E	Cleveland El Illum	Cincinnati G&E	Kansas City P&L	Union El Co	Dallas P&L	Northern States Pwr
IV—CABLES IN MANHOLES (CONTINUED)											
Repairing cracks and breaks (continued)											
At bend	Patch, flex insert: bond across	Skin-tight sleeve	Wipe knob, replace	Lead sheet, solder wipe	Solder patch	Solder	Solder	Lead burn or wipe sleeve	Solder wipe	Solder	Solder inlay, lead patch tape & paint
At duct mouth	Replace	Replace, repair & pull back	Replace	Solder or replace	Solder patch	Replace	Pull slack and solder	Lead burn	Solder wipe, replace	Solder	Wipe short sleeve, replace
With cable energized, max voltage	230 v	No	208 v	600 v	No	No	480 v	700 v	600 v	2.4 kv	240 v
Bend, move energized cable, restrictions	To 25 kv	No bending	Yes, good cable	To 13.2 kv	To 5 kv	.....	.....	To 13 kv	Radius over 24 in.	To 2.4 kv	Hv cables, slight moving only
Temporary repairs on lead sheath	Rub & fric tapes, asph paint	Fric tape, glypt tape & lacquer	Rubber tape friction P & B	Plastic electrical tape	Solder tape	Solder tape	Tape & glypt	Rub tape & cement	Solder wiping	Solder	Tape & paint
Protective coat under fireproofing	Parafinned cotton tape	No-Ox-Id tape, No-Ox-Id GG cmpd (11)	Amorphous wax	None	None	Paraffin cheesecloth	None	No-Ox-Id GG	None	Waterproof plastic p't.	Paraffin, cheesecloth
Maintenance	None	.....	(12)	.....	.....	.....	.....	.....	.....	As required	.....
Fireproofing of cables			Asbestos		Asbestos	Cement,	Dry glass	Woven	Asbesto-		
0–600 v	No	No	tube, tape	No	listing	sand cheesecloth	tape	asbestos	ment, asbest list (13)	No	No
Maintenance	.....	.....	.....	.....	Not severe	.....	Neg	None	None	.....	.....
601 v—10 kv	Asbestos listing	Sand, cement asbest list	Asbestos tube, tape	Asbestos listing	Asbestos listing	Cement, sand cheesecloth	Dry glass tape	Asbestos listing	Asbesto-ment asbest list	Niagrite asbesto-ment	Niagrite, asbest tape, asbesto-ment
Maintenance	None	.....	.....	.....	.....	.....	Neg	Neg	None	As required	.....
Above 10 kv	Asbestos list fire felt asbest-ment	Sand, cement asbestos listing	Rope, cement	Asbest list or asbestos cement	Asbestos listing	Cement, sand cheesecloth	Cablekrete	Felted and woven asbestos	Asbesto-ment asbestos listing	Niagrite asbesto-ment	Niagrite, asbest tape asbesto-ment
Maintenance	None	.....	.....	.....	.....	.....	Neg	None	None	As required	.....
Series	Asbestos listing	.....	.....	.....	.....	.....	Dry glass tape	.....	.....	Niagrite asbesto-ment	.....

	Boston Edison	Con Ed of N Y	Company X	Potomac El Pwr	Rochester G&E	Cleveland El Illum	Cincinnati G&E	Kansas City P&L	Union El Co	Dallas P&L	Northern States Pwr
Maintenance	None	.....	.....	.....	.....	.....	Neg	.....	.....	.....	.....
Collapsed joints	.....	Replace	Pump up, replace	Pump up, replace	.....	Replace	Pump up, replace	Replace	Pump up	Replace	Replace
Draining gas-filled cable joints	None	Once, twice 1st yr; then as needed	6 mo; then as needed	3 mo; then semi-annual	2–3 times 1st year; twice year	.....	3 mo 1st year; then yearly	Ev 2 mo 1st year; then yearly	.....	None	Sev times 1st yr; year as needed
Clogging of solid tubes	None	Blow down	Gas pressure	Gas pressure	40-psi nitrogen	.....	Gas pressure	Gas pressure	.....	None	Flush with solvent, gas
Filling schedule,	None	Insp after 1st 6 mo	Yearly to 5 yr	None	None	None	None	None	Weekly to yearly (14)	None	None
Type of joint	.....	Oil-filled	Oil-filled	.....	.....	.....	.....	.....	Oil-filled	.....	.....
Drain, fill energized cable,	No	Reservoirs	Yes	No	Yes	No	Yes	No	No	None	Yes
Max voltage	.....	45 kv	26 kv	.....	34 kv	.....	13.2 kv (15)	13.2 kv	.....	.....	240 v
V—SUBWAY TRANSFORMERS											
Touch-up painting, method used	Occ brush	Chip paint; brush	Initial install; brush	None	None	.....	None	Rusting; st'm-deterg' clean, coal-tar paint	Rusting; brush	None	Seldom
Test for submersibility, how often	6 psi air; before install	30-min drop test, 7 psi N_2; yearly; then 2 yrs	N_2 when seal is broken	5-psi N_2; at install & 2–4 mo later	No	No	Check pressure on install	Check gas pressure yearly	5 psi N_2 for 30 min; yearly	Air test when seal broken	N_2 pressure test; yearly
Repair seal with unit energized	No	Replace gaskets (16)	Very few	Adjust gasket bolts	No	.....	No	No	Small fittings	No	No
Repairs on energized units	Tighten leads	None	None	External connections	None	.....	None	Minor	None	Low-voltage side	None
Conditions requiring removal	Rusty case	Physical conditions dictate	All major repairs	All major repairs	Burnouts	Defective units	Failure, Schd. overh'l	No experience	Failure	Internal failure	Welding, internal repairs
VI—AUXILIARIES											
Regular maint'ce for crabs, limiters	None	None	None	None	None	Cleaning crew	None	Inspect 3 times yearly	None	.....	Inspect yearly
Fuses, fuse cutouts	Replace bl'n fuses as found	Inspect yearly	Inspect after fuse operation	With other work	None	Continuous inspect; tong-test yearly	Insp month remove, clean	Tong-test yearly	Inspect yearly	8 mo.	Clean year plate contacts
Buses	.....	Inspect yearly	None	None	None	.....	Inspect in vaults monthly; manhole yr	.....	None	Yearly	Inspect vaults bi-weekly

(11) These materials used under cement-sand. As an alternate, duct seal, electrical insulating putty, or an electrical coating may be used under asbestos tape or blankets. (12) Program underway to standardize on and replace previous coatings with amorphous wax. (13) Lead covered cable only. (14) Schedule calls for weekly filling of high spots and "leakers," monthly filling on slopes, and annual checking of all oil-filled joints. (15) Shielded joints only. (16) On low side of network protector.

BOOK REVIEW

Handbook Revised to Aid Lineman Training

New 3rd edition presents clearly current information about:

- Elementary electricity
- Line material and equipment
- Pole handling and setting
- Equipment installation
- Line patrol and inspection
- Working methods
- Accident prevention, first aid
- Power systems and circuits
- Line design fundamentals
- Tower erection
- Conductor stringing and joints
- Live-line testing and repair
- Tree trimming
- Electrical calculations

The Lineman's Handbook—3rd Edition. By E. B. Kurtz. Published by McGraw-Hill Book Co, Inc, 330 W. 42nd St., New York 36, N. Y. 764 pages, illustrated. Price $10.00.

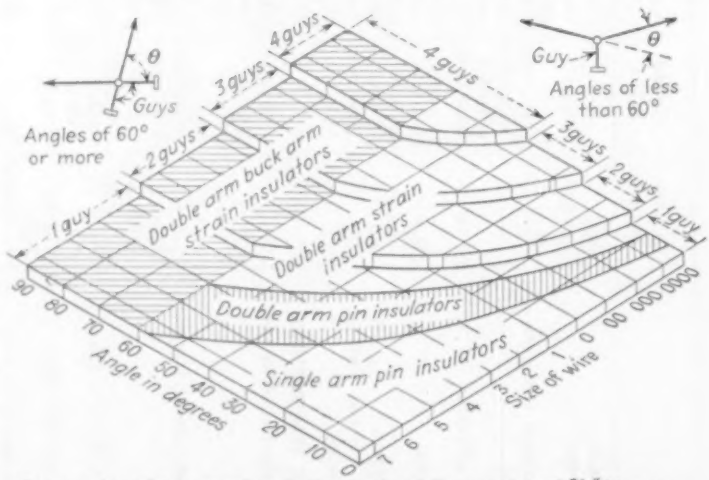
Complete revision has made The Lineman's Handbook again the most comprehensive reference and textbook for linemen and their foremen and supervisors. The new 3rd Edition has added tower line erection, live line maintenance, rural lines, use of rubber protective goods, rope knots and splices, pole top resuscitation, and electrical formulas and calculations to its scope. And material of earlier editions covering practical topics from fundamentals of electricity and descriptions of materials and equipment to the installation of transformers, tree trimming and first aid has been brought up to date.

Edited For Home Study

Author of this handbook is Prof E. B. Kurtz, head of Electrical Engineering Dept, State University of Iowa. He has written it clearly and in simple language expressly for use as a home-study book to supplement the daily work experience of linemen and apprentice linemen. About 1,000 illustrations show the steps in construction and maintenance to supplement the text. And many curves and tabulations provide information about the strength and proper sagging of overhead conductors, pole setting, and guying to support line angles and dead-ends.

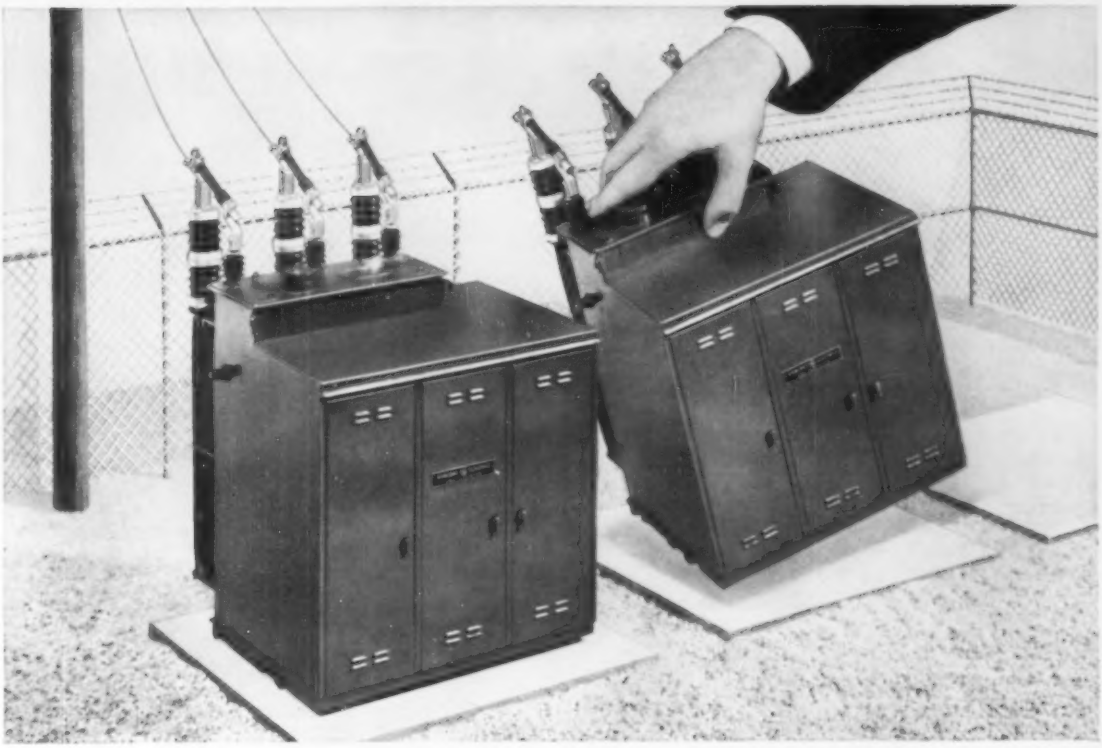
Demand for more trained linemen is causing many utilities today to establish line schools. Trainers selected for these schools because of their wide experience in line work will find valuable assistance in this new handbook. Teaching techniques mastered by its author in his long educational career and reflected in its pages can help industrial trainers to pass on their own personal knowledge and experience more effectively to inexperienced trainees. The effectiveness of the teacher determines much of the success of any class.

Design engineers preparing plants for line construction and operation and maintenance engineers whose work on the overhead plant is completed by linemen also can benefit by study of this book. Its greatest value to them is guidance in presenting instructions in such form as to be carried out by established line-work practices and expressed in terms clearly understood by linemen. But the handbook also provides quick reference for some of the more common design information; in this respect it supplements the usual engineering handbooks and data sheets.



The number of guys as given by the chart are the number of 5/16" Siemens Martin guys, of 6000-lb. tensile strength, installed at 45° angle with the pole, necessary to balance the pull of one circuit of three wires

For buck-arm poles the chart gives the number of guys required each way



G-E single-circuit unit substations help utilities keep pace with growing loads

Flexibility of application and ease of handling make multiple-unit installation an economical and fast solution.

General Electric single-circuit unit substations are an excellent means of providing power for scattered, ever-growing, low-density areas. Philadelphia Electric Company, for instance, pinpoints these G-E units near the heart of the load. As the load grows, they simply install a second, third, or fourth unit to meet demands. Incorporating transformer, circuit breaker, load tap-changing equipment, and all necessary accessories, the units can be skidded or spotted in place by mobile crane in a matter of hours. No field assembly is required.

Other utilities employ G-E single-circuit unit substations in load growth areas by moving them from one location to another as varying loads require.

No matter how you plan to use these units, you will realize many important advantages:

Money savings: Installed cost is low, and installation close to the load also means savings in copper through shorter low-voltage lines. **Space savings:** Minimum square footage required means minimum land cost, less landscaping.

Engineering Savings: Your engineering manpower can be utilized more effectively because the complete substation is designed and assembled by General Electric.

Time savings: Transporting and positioning can usually be accomplished in a few hours, and units can be shifted quickly as loads change.

For full details, contact your nearest G-E sales representative, or write for bulletin GEA-4300 to General Electric Company, Section 422-24, Schenectady 5, N. Y.

Progress Is Our Most Important Product

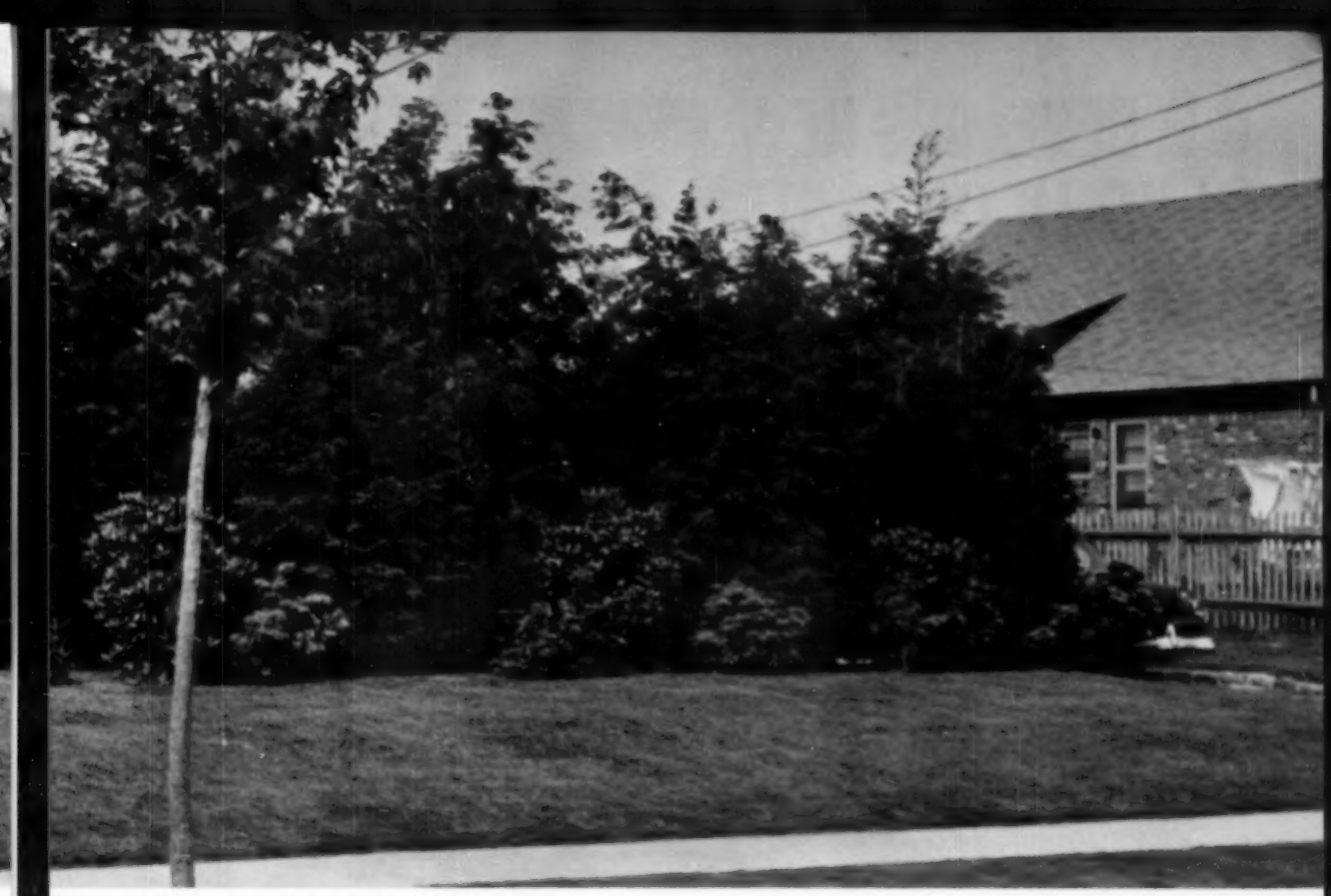
GENERAL ELECTRIC

Con Edison gained public acceptance for this Alley Pond Park.

IN NEW YORK'S SUBURBS...

CON EDISON USES UNIT SUBSTATIONS

LOW **COMPACT DESIGN** of unit substation is easy-to-install close to residential load, easy-to-landscape for neighborhood acceptance.



Long Island unit substation by use of attractive landscaping.

TO ASSURE CUSTOMER GOODWILL

The amazing post-war population swing to suburban living, plus increased electrical consumption per residential customer, has created load growth problems for utilities all over the country. A distribution system is required which can give dependable, uninterrupted service to customers, and at the same time be easily and economically expanded.

Con Edison of New York, serving one of the world's most extensive suburban areas, is one of the leading utilities that has found the answer to this problem in unit substations.

SIMPLIFIES SYSTEM EXPANSION

Advance planning simplifies system expansion, permits anticipation of load growth and substations are ordered for delivery as needed. Thus capacity is increased in small "blocks of power" and the overall system investment is substantially reduced.

NEAT COMPACT DESIGN IS EASY TO LANDSCAPE

The clean low construction of unit substations allows them to be easily and attractively landscaped, thereby minimizing objections to residential installation. Almost without exception, a well landscaped unit substation becomes a welcome neighbor in even the best residential areas. Their compact design also allows strategic close-to-load location with little installation space required.

For information about unit substations as an economical, dependable answer to load growth problems ask your G-E sales representative or write to General Electric Co., Section 512-11, Schenectady 5, N. Y.

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GENERAL ELECTRIC

G.E. DEVELOPS NEW PLUG-IN CHASSIS FOR 2-WAY RADIO

NEW PROGRESS LINE saves money on maintenance through faster servicing—protects from obsolescence because chassis are quickly interchangeable.

IN the new Progress Line, transmitter, receiver, power supply and optional chassis are individually rack-mounted in a triple-rigid mobile case. Rapid interchangeability is provided by this rack construction and true plug-in chassis. This plug-in design permits changes in frequency, power, type of reception (narrow or wide band) quickly *at minimum cost, at any time.* You're free of any obsolescence risk!

You may switch Progress Line mobile units—whether front or trunk mount, between vehicles with 6 or 12 volt DC systems. No electrical alterations are needed. And any mobile combination can be converted quickly to a low-cost, 117 volt AC intermittent duty base station by changing only the power supply chassis!

Let a G-E Communications Counselor analyze your radio needs and develop an installation or conversion program planned for long-run savings. Write or call today for full specifications on the new PROGRESS LINE. *General Electric Company, Communication Equipment, Section X19115-28, Electronics Park, Syracuse, N. Y.*

INDIVIDUAL PLUG-IN CHASSIS minimize capital investment in spares and reduce radio maintenance time! Your vehicles will be back "in service" faster. For instance, you can replace either a transmitter or receiver plug-in chassis right in the vehicle in 5 minutes—using only a screwdriver. Individual plug-in chassis of the new General Electric Progress Line units also provide complete interchangeability between mobile and station transmitters and receivers.

◀ **There is a G-E Authorized Service Station near you. Look for this sign.**

EASY FRONT MOUNTING under the dash. The new G-E Progress Line case is less than 15" deep. For the first time you can have a 90-watt front mount mobile unit in the 25-54 MC band and a 50-watt front mount mobile unit in the 144-174 MC band. In the 25-54 MC band you can now have simultaneous monitoring of 2 channels, in the same case, without additional equipment.

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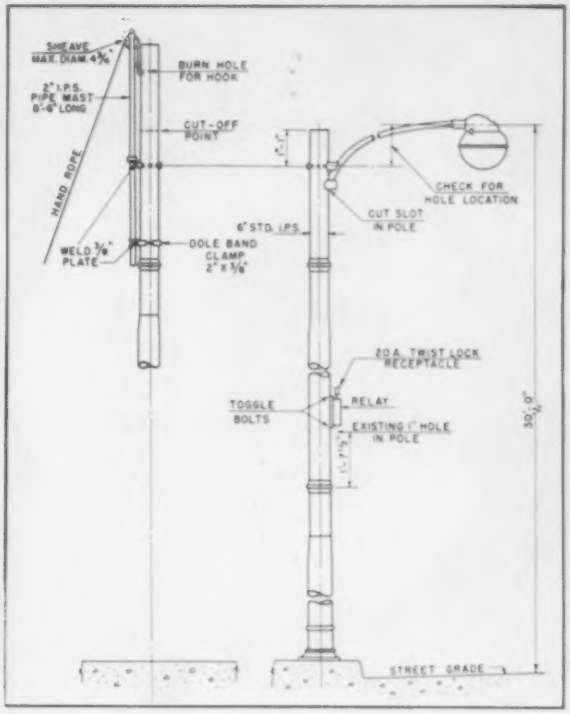
DISTRIBUTION—Construction, Maintenance



Existing steel poles were revamped for use with modern street-light fixtures to . . .

Save $137 per Pole During UG Conversion

KERMIT W. FISHER, Div Electrical Engineer, Appalachian Electric Power Co, Charleston, W. Va.

Adapting existing steel poles to modern street-light fixtures during an overhead-to-underground conversion in Charleston, W. Va., saved Appalachian Electric Power Co over $137 per pole. Because 105 poles were involved in the changeover, more than $14,400 were saved.

First step to adapt the 30-year old poles was the removal of old-style ornamental fixtures, supplied from a series circuit. Then the top 4½ ft were cut off the poles to present a better appearance with the upswept brackets for the mercury-vapor lights.

To prepare the cutting operation, a ⅝-in. hole was burned through the pole at the 28-ft 5-in. level; this hole also served later to attach the new fixtures. And an 8½-ft long, 2-in. IPS

(*Continued on page* 92)

Costs of Installing New Poles and Converting Old Poles

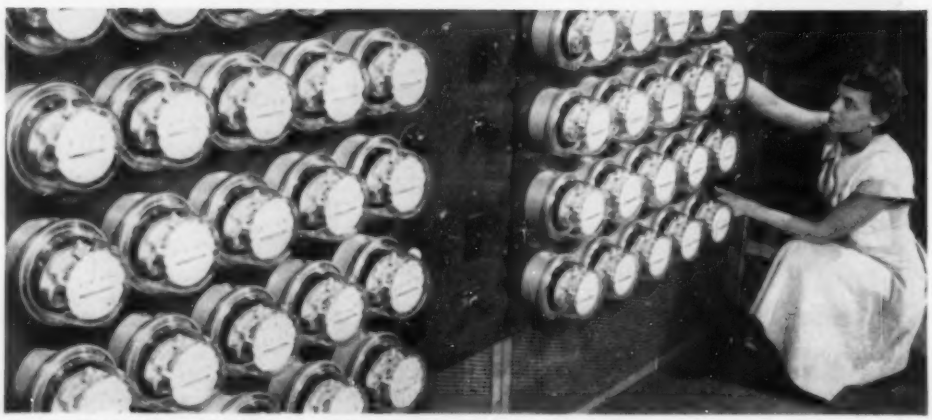
(Items common to both have been omitted)

New Poles	Cost/Pole
Purchase cost of new poles & brackets...	$96.00
Installing pole foundations complete with anchor bolts and associated underground duct entrances	35.50
Installing poles and brackets.....	12.50
Removing old poles imbedded in concrete	25.00
	$166.00

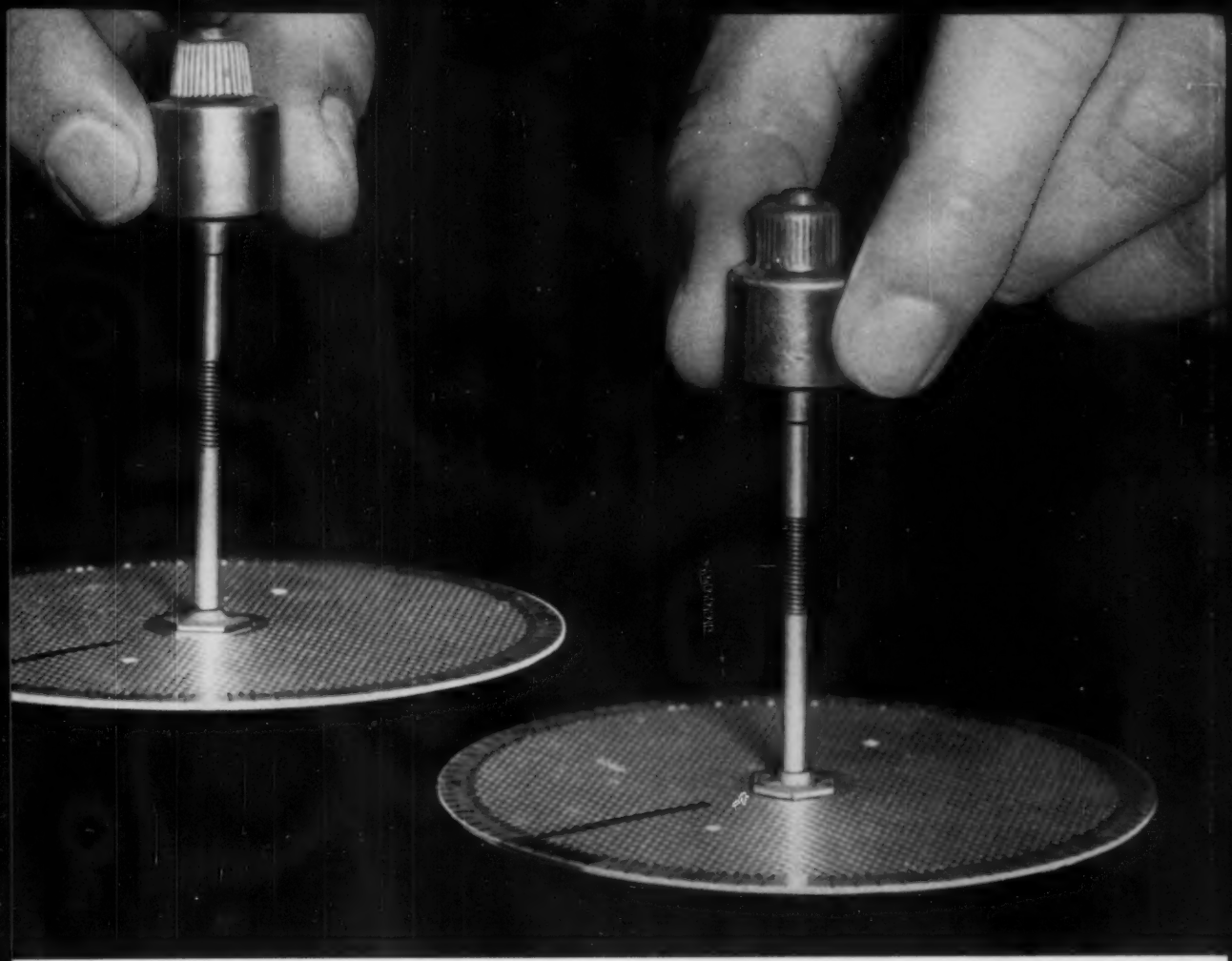
Revamped Steel Pole	Cost/Pole
Cutting off top of pole including prorata share of special—gin cost.....	$12.00
Additional cost of special pole-top adaptor	.80
Installing 2" duct connection to underground circuit	12.00
Cost of installing bracket.....	4.00
	$28.80

AFTER 250 MILLION DISK REVOLUTIONS, or an equivalent of more than 300 years of meter operation, life tests show no bearing wear in General Electric's magnetic suspension system.

Life Tests Prove...



LABORATORY RUNNING TESTS on sample lots of General Electric's I-50 meter family serve as additional checks on over-all meter performance and the lifetime characteristics of the magnetic suspension system.



No Bearing Wear

A true lifetime bearing system, already having registered the equivalent of more than 300 years' use under normal operating conditions, is now assured with all members of General Electric's I-50 meter family. Results from continuing accelerated life tests, conducted in General Electric research laboratories, prove that the revolutionary magnetic suspension system eliminates the need for bearing replacement.

These General Electric meters have registered more than 250 million revolutions of the floating disk. This is equal to over 300 years of meter operation at the national average load of 3000 KWH annually. Results show no measurable wear on the graphite washer or guide pin in G.E.'s magnetic suspension system.

These tests substantiate the perfect record of the magnetic suspension system in the more than 6,000,000 I-50 meters in service today. They offer proof that G.E.'s meter family—by eliminating bearing maintenance and replacement expenses—assures you of lower metering costs. For more information contact your nearest G-E Apparatus Sales Office or write General Electric Company, Section 621-4, Schenectady 5, N. Y.

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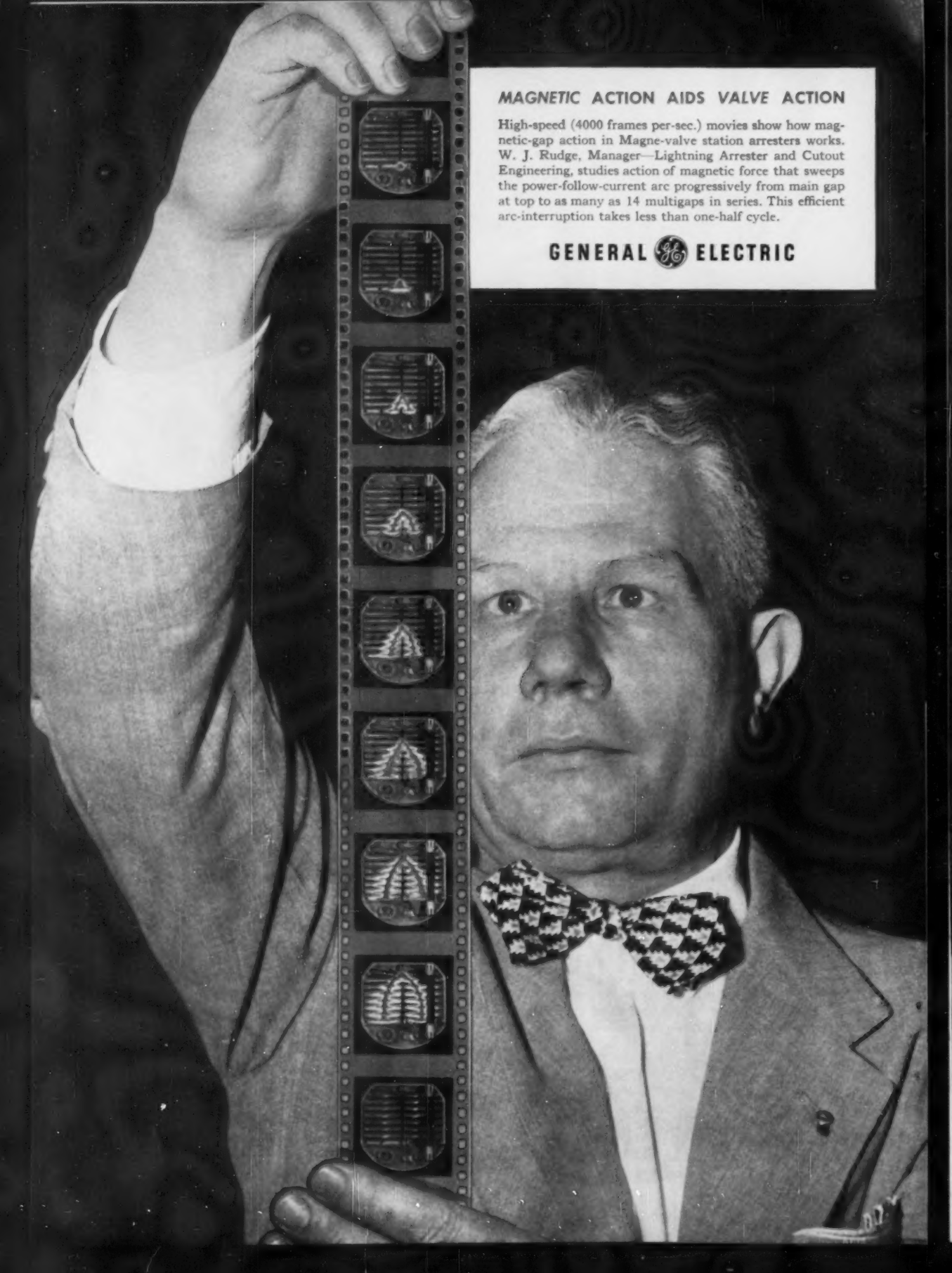
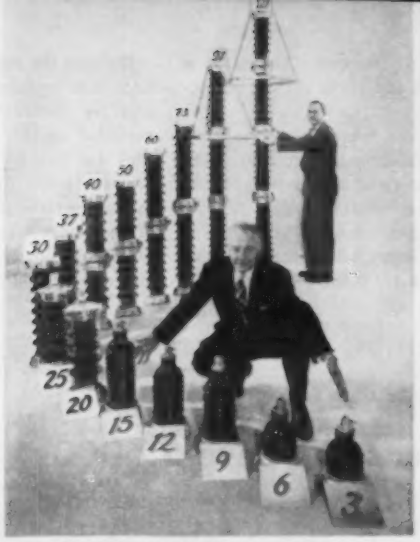


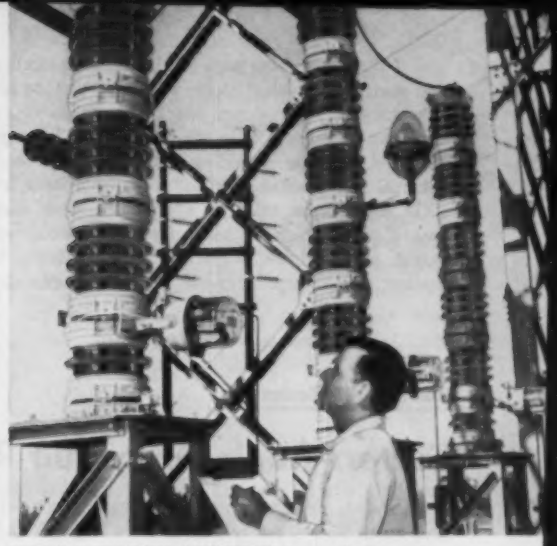
MAGNETIC ACTION AIDS *VALVE* ACTION

High-speed (4000 frames per-sec.) movies show how magnetic-gap action in Magne-valve station arresters works. W. J. Rudge, Manager—Lightning Arrester and Cutout Engineering, studies action of magnetic force that sweeps the power-follow-current arc progressively from main gap at top to as many as 14 multigaps in series. This efficient arc-interruption takes less than one-half cycle.

GENERAL ELECTRIC



NEW G-E LINE ARRESTERS have far higher reliability because of Thyrite Magne-valve design. Seven new ratings extend line from 3–121 KV.



NEW G-E STATION ARRESTERS have discharged lightning currents of 20,000 amperes with up to 30 operations per year recorded in actual service.

NEW G-E station and line arresters with exclusive "Magne-valve" action give 20% greater lightning protection

That high-speed movie film strip at the left shows the most significant forward step in lightning arresters in the past 25 years. You're looking at the magnetic-gap action of General Electric's "Magne-valve" principle—a combination of *magnetic* action of series gaps and *valve* action of improved Thyrite* disks.

HERE'S WHAT IT MEANS TO YOU: MAXIMUM LIGHTNING PROTECTION.

On both station and line arresters, you get as much as 20% more protection. With "Magne-valve" station arresters you get *protection* for one-step reduced insulation equal to that previously given to full insulation; better *protection* to rotating machines and dry-type transformers. You get three times greater discharge capacity to withstand multiple strokes, severe switching surges, and long-duration discharges.

LINE OR STATION— WHICH SHOULD YOU CHOOSE?

G.E's new "Magne-valve" principle has resulted in improved performance for both. Although there isn't any simple formula that can be applied everywhere, G-E station arresters are generally preferred for locations where size and importance of apparatus demand the best in protection for uninterrupted service continuity.

But the final selection depends on your particular application—the economics and engineering involved in each specific location.

To help you select the right type of Magne-valve arrester, call in an Application Engineer from your local G-E sales office. Bulletins GEA-1304 (New Station Arrester) and GEA-2978 (New Line Arrester) are available for the asking. Write to General Electric Company, Schenectady 5, New York. 4324-3

*Reg. Trade-mark of General Electric Co.

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GENERAL ELECTRIC

(*Continued from page* 87)
pipe mast was attached to the pole by two brackets: The upper bracket is held by a through bolt in the burned hole, and the lower is held by a standard steel-pole band clamp.

On top of the mast is a 4¾-in. sheave over which a hand line is passed, and its hook is inserted into another hole burned near the top of the section to be cut. The mast is used to hold and lower the cut off section.

To cap the 6-in. poles a special cast-iron adapter was purchased from a local foundry at a unit cost of 80¢ more than a standard adapter. The special adapter holds the standard pole-top ballasts, which are made for smaller-diameter poles.

Because the revamped poles had no hand-hole openings, the mercury relays for controlling the lights were mounted on the exterior of the pole. This was done by inserting toggle bolts into the holes formerly required for the old street-light fixtures. On top of each relay was mounted a 20-amp, twist-lock, power receptacle for serving festoon lighting, etc.

SUBSTATIONS—Design

Gutters Replace Conduit Runs and Save $2,000

Overhead metal gutters for substation control wiring save about $2,000 per installation for Puget Sound Power & Light Co. Gutters replace the use of costly separate conduit runs and spares in the concrete slab foundation. Overhead wiring in gutters reduces the length of wire runs, and the gutters may be installed along with other fabrication in the substation to save time and effort.

Overhead gutters were suggested by a cost analysis revealing that a large share of labor cost was attributable to the placing of conduit before any overhead work. Puget Power engineers worked up a simple, low-cost design. Gutters consist of a 4x4-in. covered trough of 16-gage metal made up in 10-ft lengths, and have side openings throughout their full length. The openings are covered by 5-ft panels fitted with side handles. Edges of the covers are offset to provide overlapping joints to keep moisture out.

The gutter takes off at the roof of the control house and makes one 90-deg turn to serve the oil circuit breakers, station service and instrument transformers, and station lighting. Short length of conduit run from the gutter to each unit.

Use of gutters simplifies the installation of a new substation. All concrete may be poured at the same time and the pouring may be followed by these operations: preparation of footings and ground; fabrication of structures and gutters; and installation of equipment and wiring.

GUTTER eliminates costly conduit runs and spares, and simplifies planning and installation of substation wiring

GENERATION—Operation

Atom Waste Sunk at Sea In Concrete Containers

Containers that are basically heavy aggregate concrete, 4 to 6 in. thick, surrounded by a mild steel shell, are used by Britain's Atomic Energy Authority for disposing of really hot radioactive wastes at sea. These are dumped several hundred miles out in the Atlantic beyond the Continental shelf where the water depth is at least 2,000 fathoms, and there is no trawling by fishing boats. Solid wastes are first concentrated by incineration.

Drums Dropped in Pairs

Inside the concrete of the container is a polythene-coated steel drum bedded in gravel, and the concrete top is poured in place. The 7,000-ton Royal Navy Fleet Auxilliary Fort Rosalie, assigned to this duty, often dumps more than 1,000 tons at a time, sometimes as far as 1,000 miles at sea. Usually drums are dropped at sea in pairs.

Effectiveness of the drums was demonstrated when, one pair breaking apart, one container dropped into the ship's hold. Although the outer casing was broken and some gravel packing spilled out, nothing escaped from the inner container nor was there any contamination of surrounding objects or people.

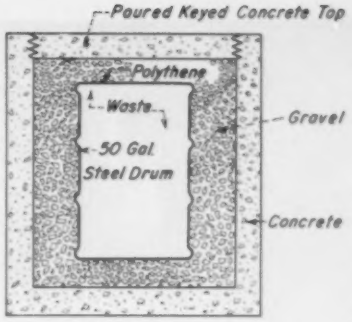
Exposure Levels Set

British atomic waste disposal is governed by recommendations of the In-

ternational Commission on Radiological Protection and the British Medical Research Council. These state maximum permissible radiation exposure levels which will not cause "appreciable bodily harm" to a person.

Three Methods Used

The AEA gets rid of radioactive garbage in three basic ways: By exhaustion into the atmosphere; by burial in the ground; and, by dumping into the sea. In some instances, there may be an intermediate period of storage. The method used depends largely on the materials' radioactive intensity and half-life.



Problem Seen Growing

The Authority is fully cognizant that, as Britain's atomic power program gets rolling, the waste problem will loom larger, only a portion of such materials finding markets as radio isotopes for use in medicine, agriculture, and industry.

SUBSTATION—Maintenance

Special Wrench Removes Spline-Type Nuts Safely

JAMES CRAVENS and
JAMES MENDENHALL, Deer Creek Station, Indiana & Michigan Electric Co, Marion, Ind.

A wrench for removing caps from Type L bushings having spline-type nuts has been developed in this division of Indiana & Michigan Electric Co. Use of the special wrench eliminates the need for a pipe wrench and thus prevents scarring of the brass or aluminum caps and cuts in workmen's hands.

The wrench was made by welding two pieces of ¾-in. rod to a washer-type ring. Grooves in the ring, for fitting the plines, were made with a rattail file. A total of four man-hours was required to fabricate the wrench from scrap.

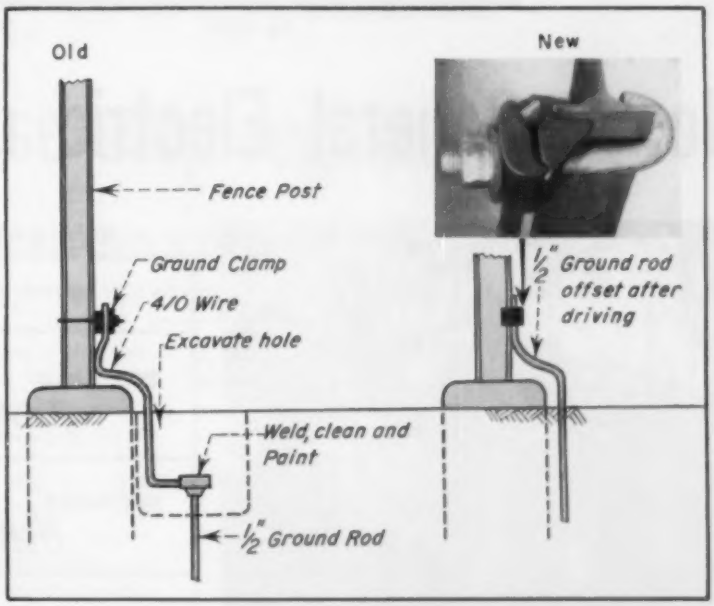
Removing caps with this wrench is much easier. The wrench fits tightly to the cap and pressure is evenly distributed, preventing damage.

SUBSTATIONS—Design

New Fence Grounding Procedure Cuts Costly Operations

OLAF OLSON, Construction Supervisor, Atlantic City Electric Co, Atlantic City, N. J.

JOHN TUCKER, Asst. Tech. Service Engineer, Burndy Engineering Co, Norwalk, Conn.



A new procedure for grounding H-section fence posts has provided Atlantic City Electric Co with a 750% savings over the former method. The reduced cost was derived by eliminating many operations and using a less-expensive means for making connections.

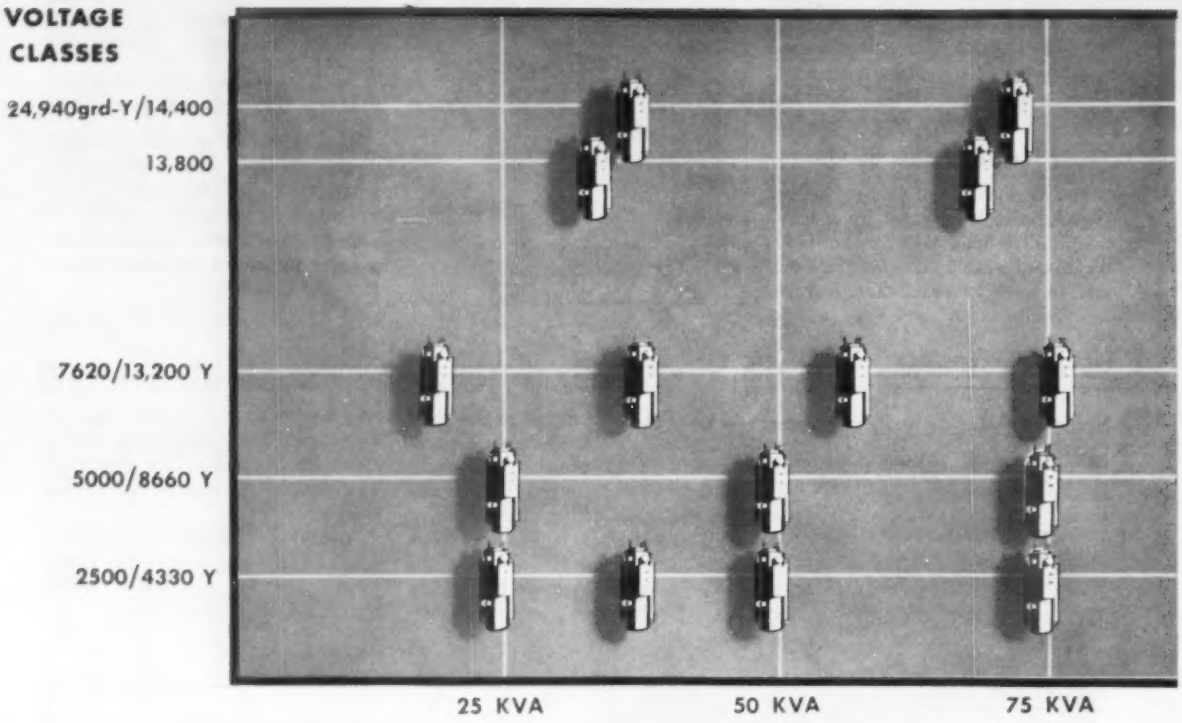
The new grounding procedure resulted from a work simplification survey of the old method which involved the following steps:

1. Dig a hole next to the footing.
2. Drive a copper-clad rod into the ground at the bottom of the hole.
3. Weld a 4/0 solid copper wire to the rod.
4. Clean and paint the weld to prevent corrosion.
5. Connect copper wire to post.
6. Backfill hole.

Because the only requirement for a good ground is a driven rod attached to the post, the company decided to eliminate the time-consuming, more-costly operations of digging, welding, and painting. Now the grounds are made by driving a longer rod into the earth next to the post. The rod is then trained to the post and connected.

Use of a new-type ground connector that fits a range of fence posts saved an additional $5 per post.

(*More How To on page* 102)

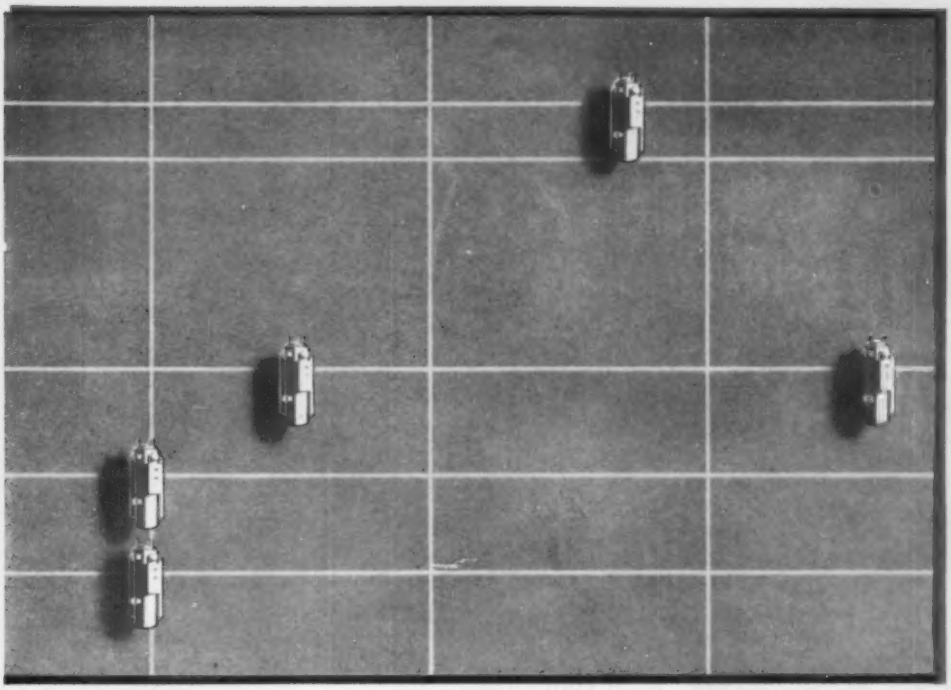


Now... General Electric doubles KVA

SINGLE-PHASE ML32 step-type feeder voltage regulators provide 10% raise and 10% lower in 32, ⅝% steps.

KVA RATINGS and CURRENTS

VOLTAGE	KVA	AMPERES at ±10% (rating)	AMPERES at ±5%
2500/4330 Y	25.0	100	160
	37.5	150	240
	50.0	200	320
New	75.0	300	400
	100.0	400	400
5000/8660 Y	25.0	50	80
	50.0	100	160
New	75.0	150	240
	100.0	200	320
7620/13,200 Y	19.1	25	40
	38.1	50	80
	57.2	75	120
	76.2	100	160
New	114.3	150	240
	167.0	219	350
13,800 New	34.5	25	40
	69.0	50	80
24,940grd-Y/14,400	36.0	25	40
	72.0	50	80
New	144.0	100	160



100 KVA 125 KVA 150 KVA

7 new ratings give you a new opportunity to provide low-cost regulation on your growing feeders.

# of single-phase step regulators

and OFFERS INCREASED CURRENT CAPACITY AT ±5% WITH MULTI-AMP

Now you can get G-E, single-phase step feeder voltage regulators, in four voltage classes, with doubled KVA ratings. Seven new, larger sizes enable you to more economically provide better voltage control on your heavily loaded feeders.

In addition, you get a 60% bonus with this line of G-E 32-step regulators, as they will carry 160% of rated current (up to a limit of 400 amperes) when operated at ±5% regulation. Providing additional capacity on your heavily loaded feeders, these regulators help assure customer satisfaction and give you an increased dividend by holding good voltage for less investment. **Compare the relative costs** of these new regulators with other regulating methods. For instance, the price of regulators in this extended range of ML32's for three-phase service, even including individual phase control, as a standard item, *is less than the costs of other types of comparable bus regulation.*

These new regulators include all the quality features of the General Electric ML32 regulator family that give greater accuracy, longer life and superior service. Plan now to take advantage of the low first cost of these outstanding feeder voltage regulators. They can be installed on poles or platforms or in substations. Ask your G-E Apparatus Sales Engineer or Agent for price and shipment information. General Electric Co., Schenectady 5, New York. 423-6

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GENERAL ELECTRIC ANNOUNCES . . .

FIRST 1200 TO 4000 AMPERE INSTRUMENT TRANSFORMER FOR INDOOR/OUTDOOR USE

TYPE JCP-0 FEATURES BUTYL-MOLDED CONSTRUCTION

General Electric's butyl-molded line of current transformers has been extended to include the new 600-volt JCP-0. This new indoor/outdoor transformer features an ampere range of 1200:5—4000:5, plus many outstanding features.

INDOOR AND OUTDOOR APPLICATION of the JCP-0 offers you a definite cost-saving advantage. This new high current transformer fulfills both indoor and outdoor requirements, thus reducing inventory and initial purchase costs.

BUTYL-MOLDED CONSTRUCTION of the new G-E transformer provides an insulation that resists oxidation, tracking, and moisture, and is not easily damaged by accidental rough handling.

WINDOW-TYPE DESIGN is offered for through-type installations. The 5¾-inch window allows easy insertion of primary cables.

The JCP-0 meets the highest industry accuracy standards: 0.3 B-0.1 to B-2 inclusive.

For more information contact your nearest G-E representative or write to Section 581-1 for Bulletin GEC-1348, General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

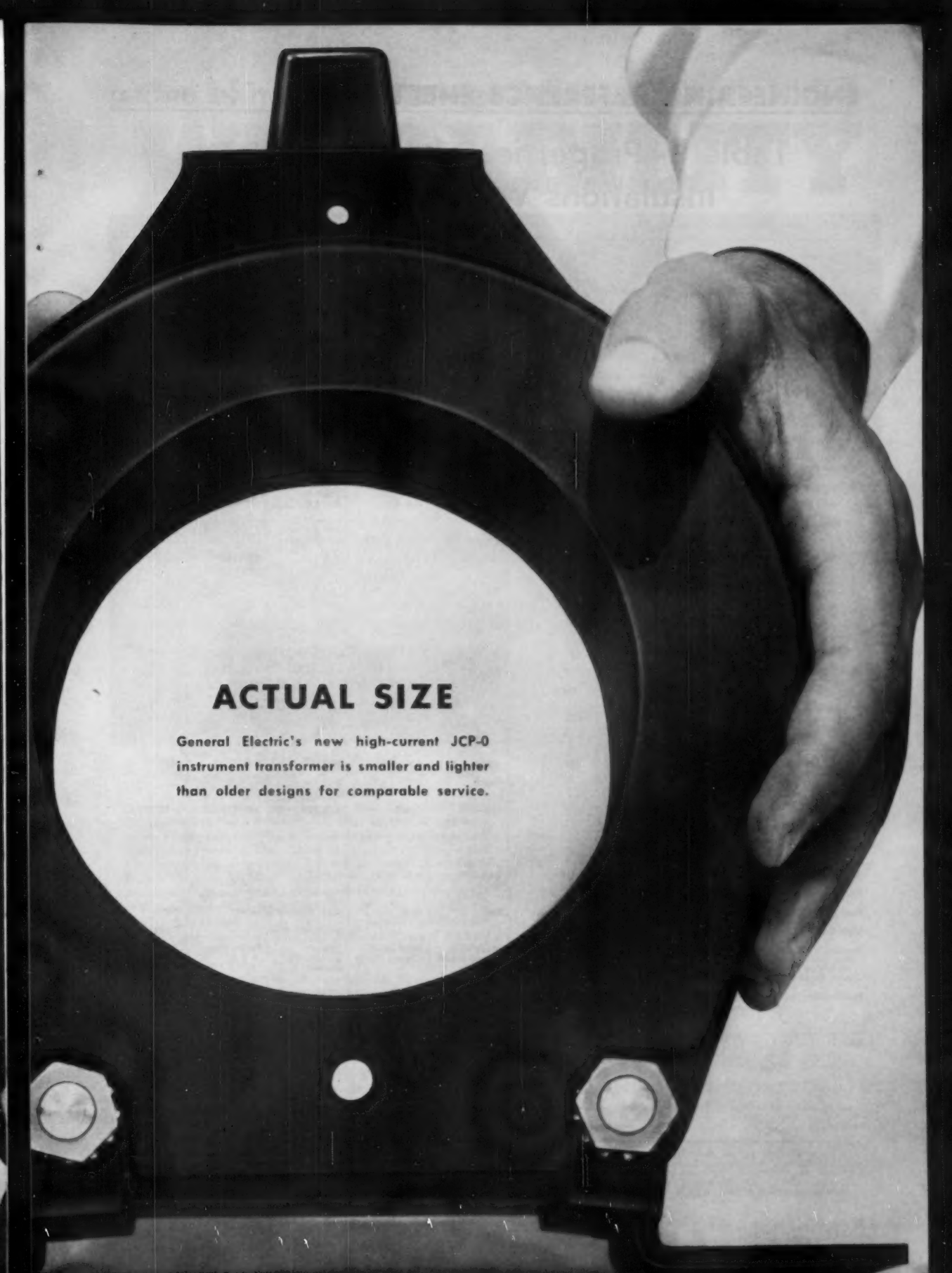

ACTUAL SIZE
General Electric's new high-current JCP-0 instrument transformer is smaller and lighter than older designs for comparable service.

Table II—Properties of Molded Plastic Insulations With Fillers: Part 2

Data Supplied by Manufacturers

Trade Name		RESINOX		PLASKON				DOW CORNING-301
Type of Plastic for Classification		Phenol-Formaldehyde		Alkyd		Urea	Melamine	Silicone
Filler: (N) Not any		Mineral	Mineral	Mineral	Mineral	Alpha Cellulose	Alpha Cellulose	Glass
(E)xtruded, (C)ast, (F)ilm, (M)olded, (L)aminated		M	M	M	M	M	M	M
Manufacturer's Grade or Number		3,700	10,900	420	426			301
Electrical Properties	ASTM Method							
Volume Resistivity, ohm-cm	D257	5.7×10^{13}	5×10^{13}	10^{13}-10^{14}	10^{13}-10^{14}			$>8 \times 10^{13}$
Dielectric Strength, vpm, 1/8 in. thickness, short time test	D149	330	400	350-400	350-400	250-300	250-300	300-400
Dielectric Constant, 60 cps	D150	8.5	5.05	6.0-6.5	5.2-6.0	7.9-9.5	7.9-9.5	4.1
10^6 cps	D150	7.3	4.93			7.0-7.5	7.8-9.2	3.6
10^8 cps	D150	5.0	4.20	4.8-5.0	4.0-4.5	6.4-6.9	7.2-8.2	3.5
Power Factor, 60 cps	D150	0.114	0.042	0.05-0.06	0.02-0.03	0.035-0.040	0.03-0.08	0.01
10^3 cps	D150	0.097	0.037			0.025-0.035	0.015-0.036	0.007
10^6 cps	D150	0.05	0.011	0.016-0.018	0.017-0.022	0.028-0.031	0.027-0.045	0.004
Arc Resistance, sec	D495	180	13	180+	180+	110-130	120-140	220
Mechanical Properties								
Specific Gravity	D792	1.83	1.71	2.22-2.24	2.00-2.08	1.47-1.52	1.47-1.52	1.65
Tensile Strength, psi: (s)tandard or (d)ry (approx 73F)	D638	6000	6000	D3,000-4,000	D6,000-10,000	D5,000-10,000	D5,000-10,000	4,400
Compressive Strength, psi	D695	28×10^3	23×10^3	16-20x10^3	24-28x10^3	25-35x10^3	25-35x10^3	10×10^3
Impact Strength, ft-lb/in., 1/2 x 1/2-in. notched bar, Izod test	D256	0.32	0.32	0.3-0.35	0.12	0.25-0.35	0.25-0.35	15
Hardness, Rockwell	D785	M105	M111			M116-120	M118-124	
Shore	D676							
Machining Qualities		Fair	Fair	Fair	Fair	Fair	Fair	Carboloy tools
Thermal Properties								
Safe Operating Temperature, F		425	350	<350	350	170	210	450
Safe Operating Temperatures, F		S	S					S
Flammability: (N)onflammable, (S)elf-extinguishing, or burning rate	D635 D757			Not S	S	S	S	
Heat Distortion, 264 psi, deg F. 66 psi.	D648	335	300	350-400	>400	270-280	340-350	>450
Brittle Temperature, F	D746							
Chemical Properties								
Water Absorption, 24 hr, %	D570	0.2	0.03	0.08-0.10	0.07-0.10	0.5-0.7	0.4-0.6	0.1
Resistance to Weathering	D795							
Basic Color		Green	Light Brown	Tan	Gray	Wide selection of colors		Red
Light Transmission						Varies with color		Opaque
Resistant to: (w)ater, (a)cids, al(k)alies, (s)alts, organic sol(v)ents, o(x)idizing compounds, (d)ilute acids, (h)ydrocarbons		W, A, V, K, S, X	W, A, V, K, S, X	Weak A, H, Organic liquids	Weak A, H, Organic liquids	Organic solvents, oils, greases	Fair to Weak A & K	W, A, K, S, V-Fair-Good X-Poor-Fair
Not Resistant to (list as above)				K	K	Poor to Weak A & K		Ethyl acetate, Carbon tetrachloride, Toluene
Uses				Ignition parts, switch & circuit breakers, Molded resistor, capacitors, TV tuner segments		Buttons, Lighting fixtures, Radio & TV cabinets, Switch plates, Sockets		Electrical Parts for switches, connectors, plugs, radio insulators, electronic equipment
Manufacturer		Monsanto Chemical Co		Barrett Div., Allied Chemical & Dye Corp				Dow Corning Corp

Second of four tables covering properties of typical plastics used primarily for electrical insulation. Part 1 was published Nov. 14, p158. Others: Table I—Properties of Plastic Insulations Without Fillers, Part 1, Oct. 17, p160; Part 2, Oct. 31, p88.

Others scheduled are ASTM-NEMA Grades of Laminated Thermosetting Sheets and Laminated Sheet Insulation not Covered by ASTM-NEMA Grades.

Compiled jointly for use in Electrical World and subsequent editions of the "Standard Handbook for Electrical Engineers."

One of many advantages of 90/10 Cupro-Nickel

WELDABILITY

Welding head on filter shell

One of the relatively new copper base alloys is 90/10 Cupro-Nickel, which is coming into increased use as a result of experience with it. Revere offers it in sheet and plate, pipe and tube. It is highly resistant to corrosion and erosion, particularly in salt or brackish water. In addition it can be cold or hot worked, welded, soldered and polished. Because its nickel content is less than the older 70/30 alloy, it is priced lower.

The item shown here is a 90/10 Cupro-Nickel filter for aviation gasoline, designed and fabricated by the Warner Lewis Company, Division of Fram Corporation, Tulsa, Oklahoma, for the U. S. Navy. Heads and shell are 1¼" thick. Revere was given the opportunity to collaborate with the Warner Lewis manufacturers on welding, which was successfully accomplished by the metallic arc process, using Inco 70/30 Cupro-Nickel electrodes. The vertical weld on the shell was X-rayed 100% and found satisfactory to pass Navy inspection. Because of the thickness of the metal, it was decided to form the heads hot at around 1690° F. The forming was done by the Hackney Iron & Steel Co., Enid, Okla., which also consulted with Revere.

Warner Lewis Company of Tulsa, with representatives in 30 cities, are specializing on all types of alloy design and fabrication and inquiries of this nature are invited.

If you wish information regarding the selection, welding, or working of copper and its alloys and aluminum alloys, see the nearest Revere Sales Office.

Completed aviation gasoline filter, made of 90/10 Cupro-Nickel

REVERE

COPPER AND BRASS INCORPORATED

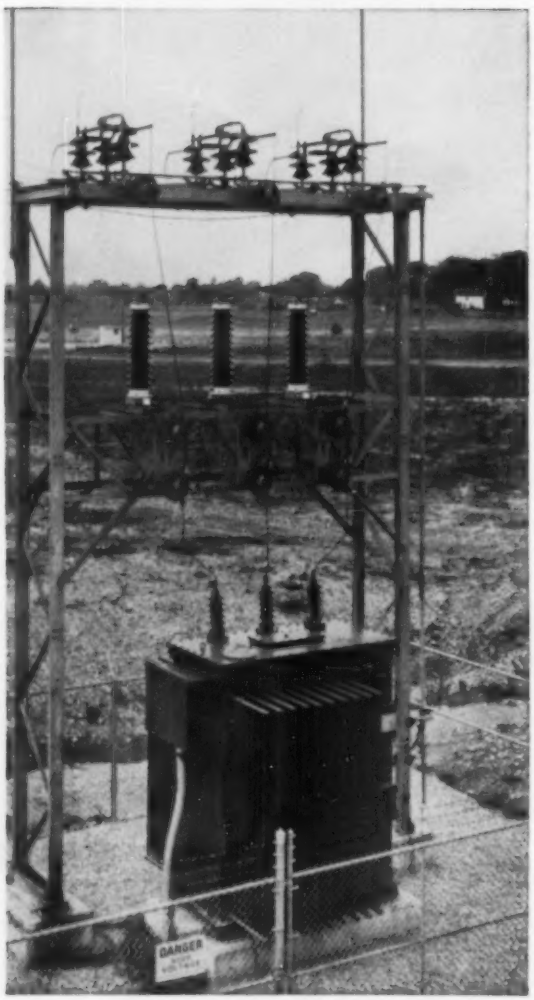
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N.Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

for the new Sylvania Television Plant...

UPTEGRAFF



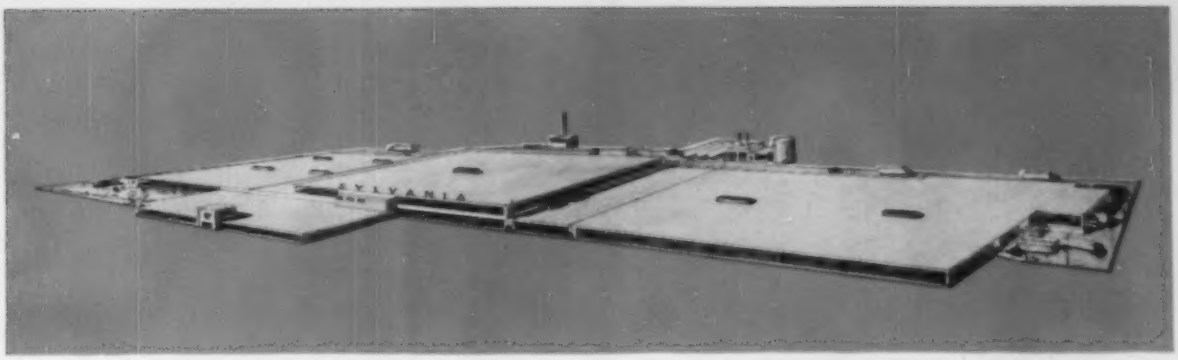
Three steps of power transformation in the new Sylvania Television Plant are supplied entirely by Uptegraff transformers. From the 2500 KVA power transformer shown at the left to the 120-volt lighting transformers shown on the page at the right, electric power is distributed by Uptegraff units.

Located in Batavia, New York, this is one of the world's largest and most modern television plants. Advanced engineering practices are employed throughout, to provide the ultimate in production facilities. The selection of Uptegraff transformers for this vital function of providing all the electricity for power and lighting is a tribute to the high quality and dependability of this equipment.

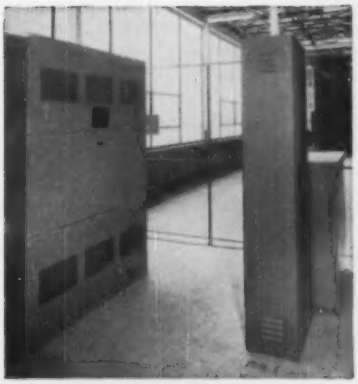
The power transformer is liquid-filled, rated at 2500 KVA, 34,400-4160 volts. The distribution transformers are dry-type air-cooled units, rated at 750, 300, 225 and 112½ KVA. In all, seven Uptegraff transformers are in service in this plant.

Uptegraff makes Power, Distribution, Instrument and Specialty transformers. Sizes are from 0.1 KVA to 10,000 KVA, 115 KV. Designed and built to meet or exceed all applicable NEMA, AIEE, ASA and other standards.

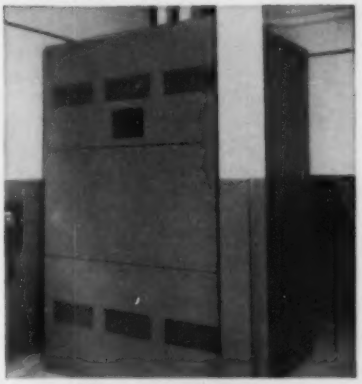
Electrical Contractor:
FERGUSON ELECTRIC CONSTRUCTION CO., Buffalo, N.Y.
Consulting Engineer:
J. FRUCHTBAUM, Buffalo, N.Y.
General Contractor:
JOHN W. COWPER CO., INC., Buffalo, N.Y.

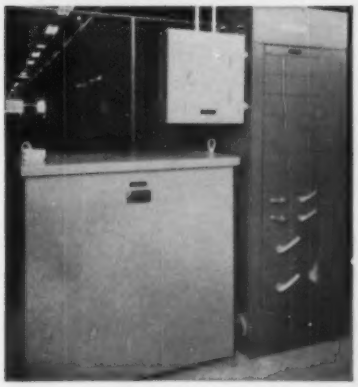


TRANSFORMERS throughout!



Shown here (left and right) are two of the four Uptegraff dry-type transformers used to provide both power and lighting current from the same distribution system, thus avoiding the duplication of units, common in the past. Two of the transformers are 750 KVA, and two are 300 KVA. All four are fed by 4160 volt circuits, and have 480Y/277 volt secondaries.



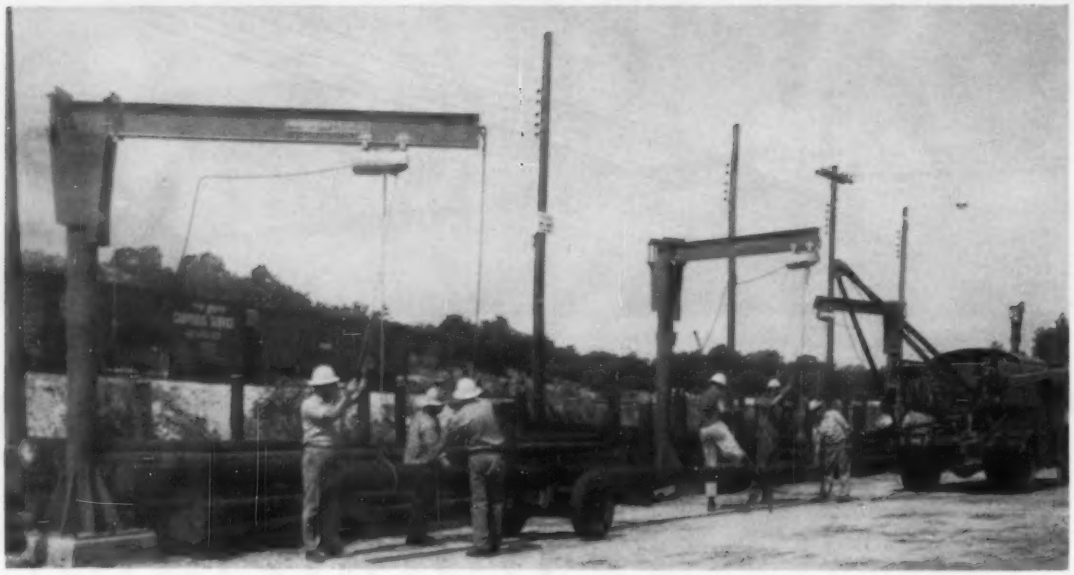


At the left is shown one of the Uptegraff dry-type transformers that provide 120-volt power. Two of these transformers are used, one being a 225 KVA unit, and the other 112½ KVA. Both have 480-volt primaries and 208Y/120 secondaries.

The photograph at the right shows how the dry-type Uptegraff transformers can be installed wherever desired, without vaults or other enclosures. This permits transformers to be safely located near the center of power usage, thus avoiding long costly runs of low-voltage circuits.

R. E. UPTEGRAFF MANUFACTURING CO. SCOTTDALE, PENNSYLVANIA

DISTRIBUTION—Maintenance—Construction



Revolving Jib Hoists Maneuver Poles Safely, Speedily

Five 1-ton revolving jib hoists at Central Maine Power Co move wood poles safely and speedily from storage bins to line trucks. They eliminate the hazard of rolling poles and cover the 50-by-15-ft work area on the basis of boat-davit operation to afford all the flexibility required for handling 30, 35, 40, and 45-ft poles.

End booms are 15 ft long, and the intermediate ones 12 ft. Jibs are rotated by handline. Cranes are on concrete bases 1 ft thick and 6 ft square above ground, and top concrete pedestals are 3 ft square carried 1 ft above ground. Normally two hoists move a pole whose maximum weight is about 1,300 lb to the line truck and dolly.

Hoist motors are supplied by a 3-phase, 240-v circuit. Fully installed each unit costs about $1,500.

TRANSMISSION—Maintenance

Stapled Barriers for Towers Discourage Gulls

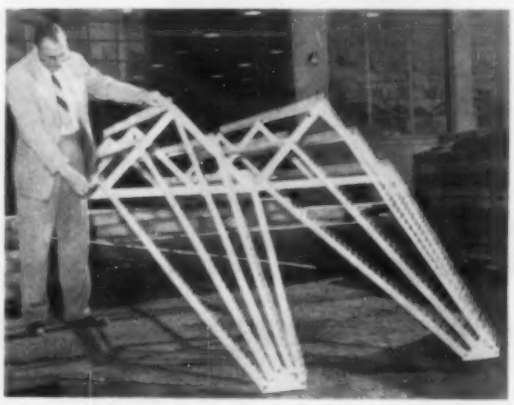
Barriers with rows of upturned staples are used by Tacoma (Wash.) City Light to keep seagulls from the tops of transmission towers across Puget Sound. Installed cost of the bird barriers is estimated at $130 each. Replacement of a steel truss section on the tower, which the barrier protects, is put at more than $1,000.

Eating habits of the gulls, rather than their presence on the tops of towers, necessitated the barriers. The gulls drop clams, shells, and algae on the 3-ft wide sections, and it was feared the salt water in these would corrode and hasten replacement of the entire steel truss section. Barriers were decided upon after failure of efforts to lure the birds to a dining place near the base of the towers.

Barriers consist of five rows of angle irons attached to triangular spacers. The structure is shaped to conform to the top of the tower. Welded at intervals to the angles are 2½-in. wire staples with the points up. Distance between angles, plus the fact that gulls land with wings spread, keeps them from landing on the truss section.

City Light reports a Chicago concern was the nearest supplier of the staples. Its order was the largest the supplier had ever received and was larger than all previous orders in the past decade.

(*More How To on page* 107)



O-B CLAMPS, RINGS PICKED FOR 345-KV LINE

Control Voltage Stress On EHV Line

O-B transmission hardware makes the conductor connection, and shields it, on this extra-high voltage transmission line. Investigations in the Ohio Brass Company High Voltage Laboratory, at Barberton, developed the hardware, and showed it to be adequate at 345 kv.

Access to the Barberton Laboratory, its tools and its intelligences, has given numerous utilities a chance to predict performance of insulators, hardware, and their combinations. Because of the laboratory findings, these companies have avoided much time-consuming development. And, they have minimized the hazard of costly trial-and-error in the field.

The O-B High Voltage Laboratory -- outstanding in the power utility industry -- is devoted to advancement of insulation for transmission and distribution. Why not discuss your insulator-hardware problems with O-B engineers? At Barberton they have the tools and the experience needed to get results!

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

Ohio Brass

SO MUCH MORE INSTALLED ARRESTER
. . . for SO MUCH LESS MONEY!

Picture of a power company saving money -- all the structural support required to erect a complete bank of 220-kv Thorex lightning arresters.

HI-TENSION NEWS / JR.

Here is a bargain of no small proportion -- the finest lightning arresters on the market, *at half price!*

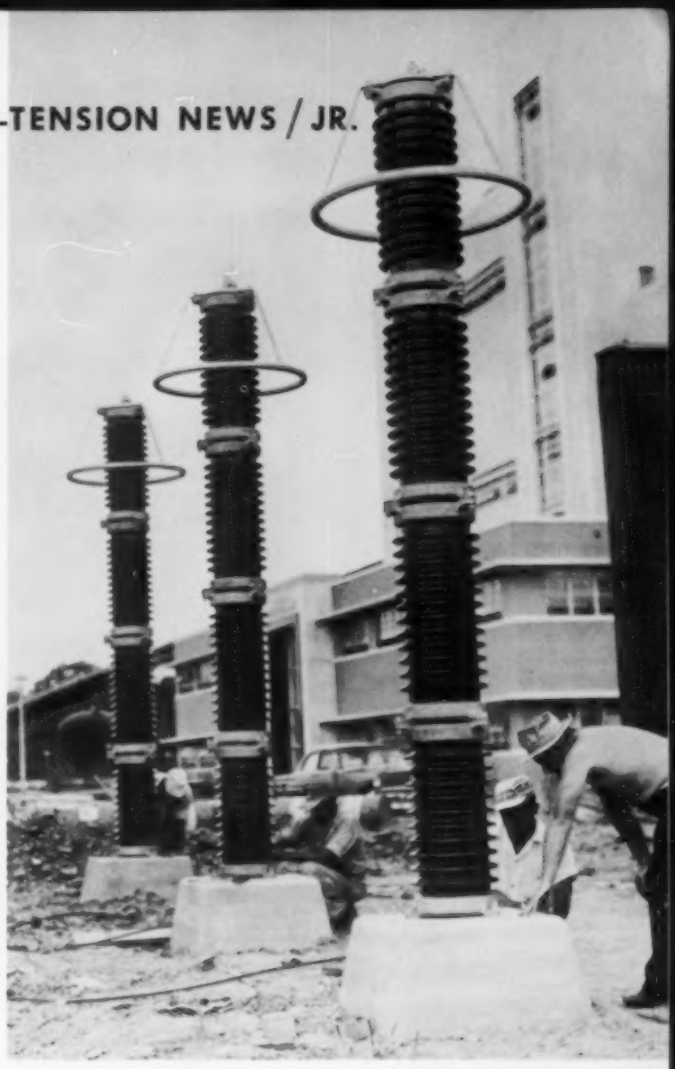
Figure it out for yourself. This 230-kv Thorex arrester bank required only three small, simple concrete bases for installation. No other structural support of any kind was needed. When such supports must be provided, their design, fabrication, erection, auxiliary insulation, and the massive piers sometimes involved, can as much as equal the cost of the arresters themselves. Eliminate all of this detail, and the final cost of the arresters can often be cut in half. This is exactly what the Thorex does for you because of its exclusive self-supporting design at all voltages.

Another Thorex economy -- all three poles of this 230-kv arrester bank were erected and completely finished by three men and a light truck-mounted hoist in one hour and twenty-eight minutes!

There's more than a mere saving of dollars with the self-supporting Thorex. Bracing insulators, connected at intermediate points in the arrester stack, when contaminated can introduce stray leakage currents that will upset unit-to-unit grading and present the possibility of serious damage to the arrester. This has been engineered out of the Thorex through the development of a simple, totally self-supported design.

Consider these facts carefully. When you realize how much *more* real protection you get for so much *less* money, you will guard your major equipment with Thorex lightning arresters.

OHIO BRASS COMPANY, MANSFIELD, OHIO



From three bare concrete bases to a completely-erected Thorex 220-kv arrester bank required only one hour and 28 minutes. Such construction simplicity is another element of Thorex economy.

the heart of every *Ohio Brass* arrester

Best qualities of two gasket materials combined to keep new O-B Bushings oil-tight

*TC

Another Extra Beyond ASA Standards that accounts for high reliability and high value

What's a few drops of oil?

Lose oil out of a bushing and, ultimately, it will be replaced by air since, as the old saying goes, "Nature abhors a vacuum." This air will contain its normal quota of water vapor. Therefore, by the simple process of a minute oil leak, the paper dielectric of the insulating condenser core can be exposed to its worst enemy -- moisture.

In O-B's new ASA Standard condenser bushing, gasketing practice for the total retention of oil has combined ingenuity with an intimate knowledge of materials.

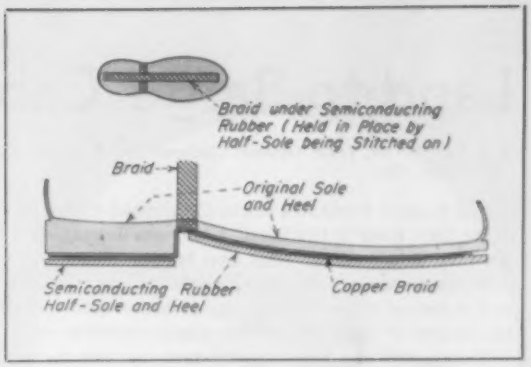
No one type of gasket could be branded as "perfect." The ideal could only be found in combining the best characteristics of two gasket substances -- cork for high mechanical stability and synthetic for maximum sealing qualities. This is accomplished quite simply. Each gasket consists of two concentric rings that permit matching-up the best in each material.

Not only is this typical of the thought that has gone into the design of new O-B bushings, it is likewise typical of what happens when over 40 years of experience are brought to bear on the development of a new product. This hard-earned know-how is repeated in various ways in almost every element of design.

For the assurance of long, trouble-free bushing life, specify O-B on your new station equipment.

the heart of every *Ohio Brass* bushing

4539-H


Braid under Semiconducting Rubber (Held in Place by Half-Sole being Stitched on)
Braid
Original Sole and Heel
Semiconducting Rubber Half-Sole and Heel
Copper Braid

Semi-Conducting Soles Reduce Static Discharge Accidents

JOHN C. SLOTHOWER,
Transmission Operating Engineer, Northern States Power Co, Minneapolis, Minn.

Semi-conducting rubber soles on shoes of Northern State Power Co linemen engaged in hot-line work on high-voltage steel tower lines have prevented accidents associated with static discharge shock.

The shoes, replacing the usual grounding chains around the lineman's ankle or arm, effectively eliminate the chance of static discharge to ground when the lineman's body is in a relatively strong electric field. Such a discharge, not as dangerous in itself as a dynamic electric shock, can startle a lineman and involve him in a serious accident. Besides it is disconcerting and uncomfortable.

These shoes and the problem of shock from static discharge are in no way connected with electric shock and the use of insulated climbers on lower-voltage lines. This problem is being worked on now by the Edison Electric Institute's Accident Prevention Committee.

The shoes are standard work footwear half-soled with rubber impregnated with carbon black or another conducting substance. Like most semi-conductors, this material's resistance varies with the voltage applied and with other factors, but affords a leakage path for capacitive charging current.

Flexible copper braid is fixed lengthwise across the sole and heel under the conducting rubber half-sole, and also across the sole under the instep. The latter braid is carried up the side of the shoe to an ankle strap. The shoe strap is lined with copper braid or conducting cloth and furnishes the contact with the lineman's skin. A leather cover protects the braid on the side of the shoe against mechanical damage.

The shoe is most effective when the rubber half-sole is carried back over the instep up to the heel. A lineman may stand for much of the time on small angles or narrow pieces of steel, only his instep being in contact. Most shoemakers, furnished with the conducting rubber and copper braid, can make the necessary alterations in a pair of standard work shoes, and the rubber is obtainable from several rubber companies.

DISTRIBUTION—Maintenance

Gas Meters Indicate Cable Trouble Spots

Gas meters indicating possible trouble spots in telephone cables have reduced maintenance costs in Southwestern Bell Telephone Co's Brownsville, Texas, exchange area.

The system, as developed by the American Telephone & Telegraph Co and Bell Telephone Laboratories, employs a compressor-dehydrator to supply air at 10 psi and —40F dew point. The dehydrated air, applied under pressure inside the sheath envelope of cables, prevents moisture from entering the sheath and damaging the paper and pulp insulation on conductors. As gas meters show changes in air consumption of the cables, the meters indicate leaks in the cable sheath before a serious service interruption occurs.

Total air passed by the unit is measured by a No. 150 Emco meter, and an individual cable receives its air through separate side-connected No. 150 Emco meters. These meters are read weekly, and the difference between this week's and last week's reading is noted. As long as the reading remains constant, maintenance forces know the cable has no major breaks.

Southwestern Bell reports that there is very little cable trouble in the Brownsville exchange area, compared to surrounding districts not using the compressor-dehydrator installation.

Land-to-Barge Cables Carry Power

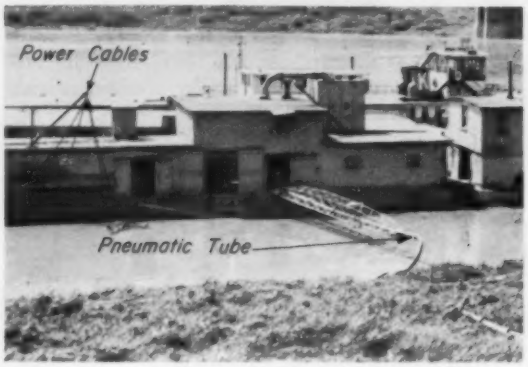
L. J. LANGEVIN, Power Engineer, Cincinnati Gas & Electric Co, Cincinnati, Ohio

The Kosmos Portland Cement Co situated on the bank of the Ohio River in Cincinnati, Ohio, uses floating electric power to unload cement from river barges.

A power supply of 480 v, 3 phase is brought from shore to a motorized barge with two sets of flexible cables. Each set consists of three 500,000-cm single-conductor rubber-covered cables in a rubber hose which excludes the river water and takes abrasion with the ground due to movement of the barge.

Two 100-hp, 480-v, 3-phase, 60-cps squirrel cage induction motors are mounted on the barge with the pneumatic conveying machinery. A motor-driven screw conveyor feeds the cement into the pneumatic system where a 100-hp motor-driven blower carries it through a special 6-in. rubber-lined flexible tube or hose into the cement silo on shore.

The use of electric power on the barge greatly simplifies the operation and is safer than any other type of drive



for this purpose. The electric pneumatic conveying equipment keeps mechanical moving parts to a minimum—essential where abrasive materials like cement are being conveyed.

Meat Is Hickory-Smoked with Electricity

R. L. GRENAN, Power Service Engineer, Public Service Co Div, Commonwealth Edison Co, Northbrook, Ill.

That delicious hickory-smoked flavor for meats is produced electrically at the Arlington Packing Co in Arlington Heights, Ill. Meats are also roasted in the same space, simply by a turn of the thermostat to the roasting temperature. But the device actually consists of two pieces of equipment—the smoke house or roaster, and the smoke generator.

For smoking hams, bacon, sausage, or ribs, the meats are hung in the smoke house. The door is closed and the thermostat set to the desired temperature. This varies from 50F to 150F depending on the meat and the results desired. The temperature may even be changed as the smoking operation progresses.

Smoke is provided by the smoke generator. Hickory sawdust is poured into the generator and is set afire. The sawdust is wetted to make it smoke profusely. Control of the draft also regulates the rate of burning to cause smoking without flame. A fan blows the smoke through piping into the smoke house.

ELECTRIC SMOKEHOUSE cures, roasts, bakes meat with 12 kw connected load

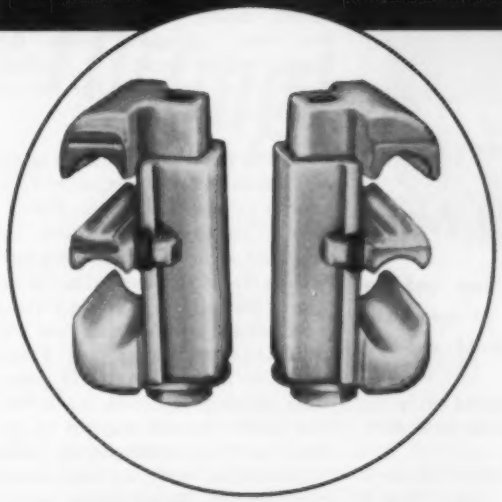
SMOKE GENERATOR uses hickory sawdust and eliminates fire hazards of gas

For roasting or baking, the smoke generator is turned off. Meats are placed in the smoke-house roaster just as though they were to be smoked. But the thermostat is set at roasting or baking temperature. This is 300F for hams. The unit is large enough to roast a whole side of beef in one operation.

Owner Chas Wassmer reports that advantages of the electric equipment are that it produces a high quality product under closely controlled temperature and air conditions, customers are pleased, and the equipment can be kept in the same building with other operations without the fire hazard attendant with flame-type equipment. This lowers the insurance rates. The electrical load is 12 kw.

...EVEN HOT...

"One Piece" FARGO CONNECTORS ARE EASY TO INSTALL



FARGO'S "9000 SERIES" FOR MAXIMUM PERFORMANCE IN SERVICE

Fargo's aluminum-bodied connectors have extra wide contact areas to overcome the high resistance of surface oxides and minimize cold flow. Larger mass gives additional radiating surfaces to hold the connector temperature under that of the conductors even under high fault currents. Well rounded corners and parabolic jaws minimize conductor damage due to physical distortion or nicking.

The soft pure aluminum spacer bar forms around the conductor excluding moisture and is a low resistance path between conductors . . . wide separation of the conductors minimizes the possibility of an electrolyte bridging the gap between the dissimilar metals.

The natural resilience of the connector body plus Fargo's exclusive vibration proof design maintains more than adequate pressure after repeated cycling. Fargo "9000 Series" connectors are available up to 397,500 ACSR.

Ask your Line Material Field Engineer for complete details.

RUBBER GROMMETS HOLD SPACER IN POSITION FOR EASE OF INSTALLATION

For hot work Fargo's "9000 Series" aluminum bodied vise type connectors are available with soft flexible grommets which hold the spacer bar in an open position so the run and tap conductors may be installed with ease. The grommets are out of the current paths between the conductors and do not interfere with the smooth easy operation of the clamp.

It is the easiest spacer bar clamp to install because it is "one piece" . . . no extra parts to assemble or threads to engage. Both hands are free to operate the hot stick.

Tool #72 courtesy of Safety Live Line Tool Company, Oakland, California. Others are available.

FARGO

Manufactured by

FARGO MFG. COMPANY, INC.

Poughkeepsie, N.Y.

Distributed by

LINE MATERIAL COMPANY

(A McGraw Electric Company Division)

Milwaukee, Wisconsin

DRIVE-IN OVEN curls over freshly painted cars to form an arch. Far-infrared heat spreads evenly, avoiding hot spots. All colors dry at about the same rate

Paint Dries on Cars in 30 Min

Technology helps bridge the gap between man and the job to be done. When man could not step up automobile output by drying paint faster, infrared could and did

Freshly painted automobiles in a repair garage now dry in 30 min in a 96-kw far-infrared drive-in oven installed at Summerfield Chevrolet Co, Flint, Mich.

Drying formerly took 7½ hr in a dust-free atmosphere, so the new oven speeds production, and reduces space formerly required for storing the cars while they air-dried.

Automatically Controlled

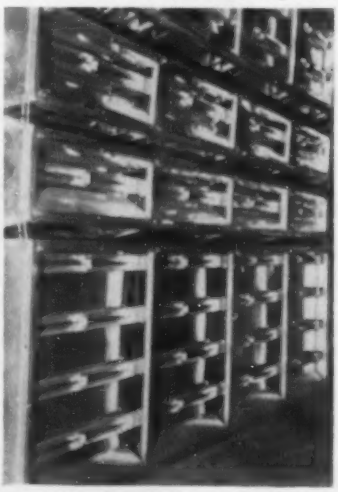
Sixty-four 1,500-w radiant heaters line both oven walls in panelled tiers. These tiers move independently to form an arch over the car to yield even heating that is free of hot-spots. Automatic controls regulate the output of the heating elements and the inclination of the panel sections. Zone control of the heaters in each panel permits spot drying with only one heating zone working.

Good for Two-Toned Jobs

Far-infrared has proved especially good on "two-tone jobs" because all paint colors absorb the long heat rays at about the same rate. In this case, the units can deliver up to 1.84 kw per sq ft of radiation, but the 30-min drying time was achieved with the variable controller merely set at 40% of heat capacity.

After the paint has dried, the car is driven onto a wash rack. Here a cold-water spray hardens the paint.

Photos by Edwin L. Wiegand Co



DRYING BIG TRUCKS is done with the tier of panels used as vertical walls

INDUSTRIAL BRIEFS

Cutting odd shaped holes in tungsten carbide and tool steels is accomplished easily at Sturdy Tool & Gage Co, Detroit, with a 2.5-kva precision electrical discharge machine. This machine creates a series of intermittent electric arcs which disintegrate the hardest metal into minute particles without changing the hardness of the material. Alternating current, is used at frequencies of 20,000 cps and above, half-wave rectified. Any shape of electrode may be used, enabling an unlimited variety of holes, cavities, slots or keyways to be cut with equal ease. High-quality results have been obtained that were impossible before this method was developed. J. P. Lenihan, Power Sales Engineer, The Detroit Edison Co, Detroit, Mich.

Leather is finish dried, after tanning, in a 300-kw infrared oven at the Gutmann & Co plant in Chicago. Following the tanning process, hides are placed on a chain conveyor and pass through the infrared oven. The advantage of the infrared finishing process is the accuracy with which time and temperature can be controlled. Finish coats are applied at several points along the conveyor and the leather then passes through sections of infrared ovens for quick drying. Both conveyor speed and oven temperature are controlled. Safety devices switch off infrared lamps when the conveyor stops. This method of finishing eliminates handling problems and increases production. R. V. Englund, Power Service Engineer, Chicago North Div, Commonwealth Edison Co, Chicago.

Tallow storage heating problems were solved at the Ubiko Milling Co, Cincinnati, Ohio, by use of eight 1,200-w electric strip heaters. The tank is 6 ft in diam, 12½ ft high, and is insulated with 2 in. of glass fibers. The eight heaters, four around the bottom of the tank and four up one side, are controlled by two thermostats which keep the tallow in a molten condition at about 130F, ready for instant use. The electric heaters were economical in first cost, easy to install, obviate firing the plant's boiler at night and on weekends. Monthly operating costs average $12. Thomas V. Morrow, Power Engineer, Cincinnati Gas & Electric Co, Cincinnati, Ohio.

Through 500 KVA

PROOF of Insulation Quality

on all Allis-Chalmers distribution transformers through 500 kva, 69 kv and below is now shown on every unit. The "Impulse Tested" Seal is put on to show that each unit has been checked with the most modern impulse testing equipment and techniques known to the industry.

Production-line impulse testing was initiated by Allis-Chalmers eight years ago for pole-type units. Now these tests that assure insulation quality are made on every distribution transformer shipped by Allis-Chalmers, including both conventional and self-protected units.

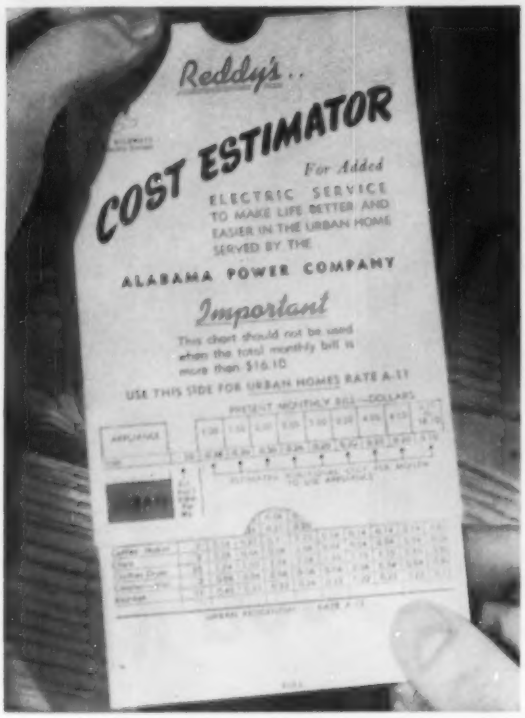
Tests are made without lightning arresters. Allis-Chalmers checks the transformer, not the lightning arrester.

Get the facts about these and other Allis-Chalmers tests and manufacturing procedures that result in distribution transformers of the highest quality. Call the A-C office nearest you, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin. A-4851

EVERY Allis-Chalmers Distribution Transformer gets this test of Quality

A-C ALLIS-CHALMERS

ALLIS-CHALMERS



COST ESTIMATOR, made of cardboard, is used like a slide-rule to determine additional energy costs for 28 appliances

Simple Sales Tool Estimates Energy Costs for Appliances

A slide-rule type of estimator for determining the amount that a new appliance will add to a customer's bill has been developed by R. W. Graham, director of dealer sales promotion, Alabama Power Co. Use of the simple tool provides appliance dealers, who are not familiar with the company's rates, with cost estimates for urban and rural customers.

The estimator works like a slide-rule. Tabulated on both sides of the slide are 28 appliances with estimates of average monthly energy use and costs, calculated for nine different "present monthly bill costs." On one side of the slide the costs apply to urban rate and on the other side to the rural rate.

In both sides of the slide holder is a slot through which the data pertaining to one appliance can be seen. Printed above the slots are the "present monthly bill costs" that match up with the energy costs for appliances.

The only information a salesman needs to use the estimator is the customer's average monthly bill. Then he sets the slide to the appliance desired, and under the column showing the amount of money closest to the customer's bill he finds the additional energy cost for the appliance.

Alabama Power has distributed the estimators to sales personnel in over 1,200 dealers' stores. The cost is approximately 10¢ in quantities of 5,000 or more.

EEI to Repeat 'White Gloves' Promotion

White Gloves will help sell electric ranges again next spring.

Edison Electric Institute announces its "Electric Cooking Is White Glove Clean" coordinated promotion of last spring will be repeated in March, April, and May of 1956.

Sample materials are now being distributed, and utilities are asked to place their orders before Dec. 16.

Last year nearly one-third of the nation's estimated 65,000 major appliance dealers tied into the program, and Robert L. Coe, chairman of EEI's Residential Promotion Committee and residential sales manager of Union Electric Co of Missouri, expects even better participation in the second campaign.

Promotional materials will include a new display kit, according to E. J. Hurley, chairman of the EEI Range Subcommittee and director of residential and rural sales for Detroit Edison Co. Included are wall and window banners, self-sealing stickers, and tent cards.

Running concurrently with the range effort will be a "Why Worry—Get an Electric Water Heater" program. Samples of promotional pieces (featuring a three-dimensional mobile) already have been mailed and deadline for orders is Dec. 2.

Both campaigns will offer consumer giveaway material which can be ordered separately from the display matter.

Reprints Available

Reprints of the 16-page Electric House Heating section from the Nov. 14 issue are available at 20¢ a copy. Bulk prices on request. Write: Reprint Manager, Electrical World, 330 West 42nd St., New York 36, N. Y.

More Dishwasher Push in '56 Says NEMA Unit

With manufacturers' sales figures showing healthy gains, the Household Sink Units Section of the National Electrical Manufacturers Association has announced it will carry its dishwasher promotional program through 1956.

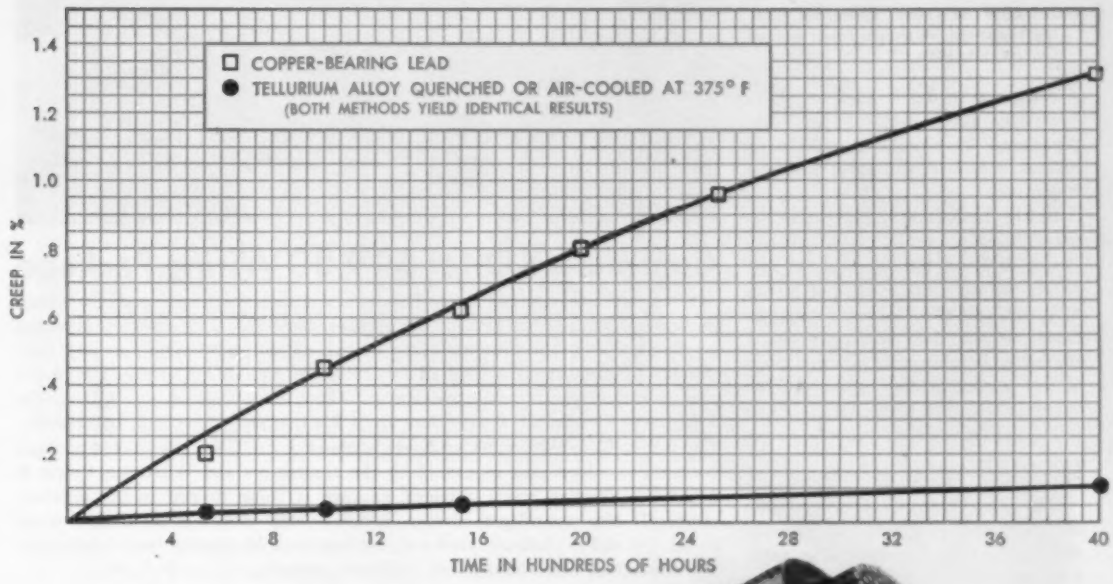
J. Don Mason, chairman of the section's Dishwasher Activities Committee, said manufacturers' sales figures as reported to NEMA show an increase of approximately 50% in units shipped in the first seven months of 1955 as compared with 1954. He said the '56 program will have its formal "kickoff" at the Chicago market in January.

"We are confident," declared Mason, "that many light and power companies who watched the progress of this year's program will be inclined to spearhead a promotion in their communities. It is planned to make a full report to these companies based on last year's Cincinnati promotion.

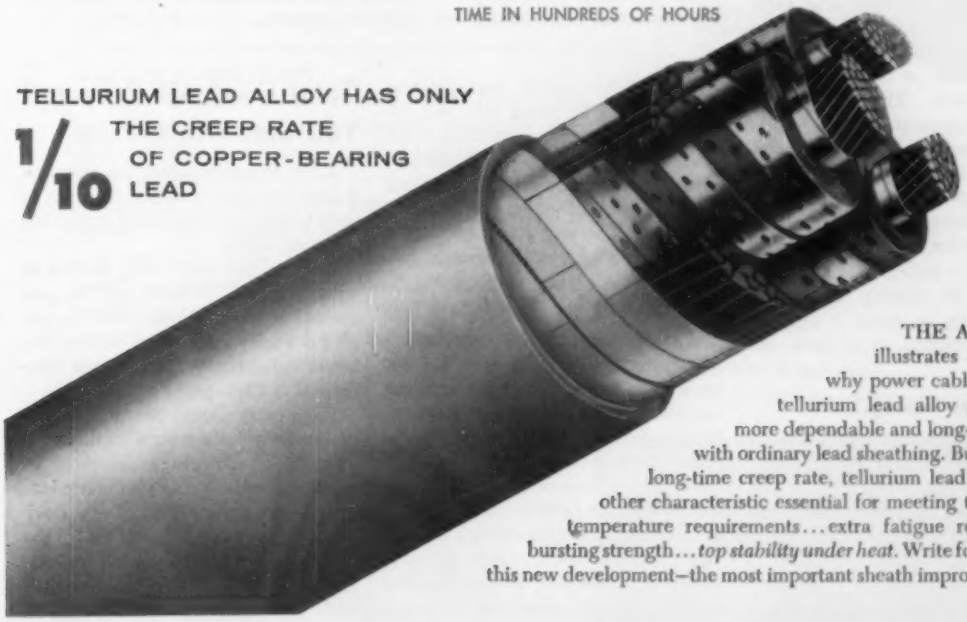
(*More S&S on page* 114)

ROEBLING PAPER POWER CABLE WITH TELLURIUM LEAD ALLOY SHEATH

CREEP OF TELLURIUM LEAD ALLOY AND OF COPPER-BEARING LEAD AT 200 PSI - 150° F



TELLURIUM LEAD ALLOY HAS ONLY **1/10** THE CREEP RATE OF COPPER-BEARING LEAD



THE ABOVE GRAPH illustrates one big reason why power cable with Roebling tellurium lead alloy sheath is vastly more dependable and long-lived than cable with ordinary lead sheathing. But besides its low long-time creep rate, tellurium lead alloy has every other characteristic essential for meeting today's load and temperature requirements... extra fatigue resistance... high bursting strength... *top stability under heat.* Write for full facts about this new development—the most important sheath improvement in years.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 924 AVON AVE. • BOSTON, 11-15 STILLING ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13235 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • PITTSBURGH, 1723 HENRY W. OLIVER BLDG. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

Lights Sell Wiring

MP&L finds wiring goes into existing homes "as matter of course" when lighting is sold

WOODROW BENTON, Residential Lighting Supervisor, Mississippi Power & Light Co, Jackson, Miss.

Adequate wiring is hard to sell as a package all by itself. Today, after experience in promoting AW, most utilities, I believe, will agree with this statement.

But by combining it with a residential lighting promotion at Mississippi Power & Light Co, we find we are selling wiring jobs in existing homes more or less as a matter of course. Once we stimulate consumer action for better lighting, the wiring follows almost automatically. Thus we can sell a well-lighted home and a wiring job at the same time.

Specialists Sell in Homes

The idea currently is being tested in a year-long program—an all-inclusive promotion based on the same kind of year-round activities we use to sell appliances. Home lighting specialists make an average of 90 calls per month. Their efforts are supported by mass promotion, dealer and builder contacts, and full coverage of all lighting equipment channels. Object of each call is to sell a complete home lighting job: fixtures as well as portables, glamor lighting as well as light for seeing. After the customer is sold on wanting better lighting, the wiring to make it operate, while not incidental, is at least secondary.

Woman Buys Wiring

Example: A Jackson lady's interest was awakened recently by a lighting demonstration she saw at a recent meeting of her woman's club. She requested help in planning the lighting for her eight-year-old, 1,500-sq ft house.

Before any actual work was begun on lighting, the wiring system (service entrance, interior wiring size, and load capacity) was discussed. Many complaints were forthcoming—the television set did not register a full picture, the washer and dryer would not operate at the same time, the air conditioner would not run while the washer was in use.

The utility's wiring specialist was called in, and he found only two circuits serving the home through a 30-amp, 2-wire entrance. In accordance with his recommendations, a breaker box was installed plus a 3-wire No. 6 entrance cable and 12 new circuits. This made a total of 14 circuits.

Lighting Load Now 2 Kw

Although a complete lighting job was recommended, the lady did not install it in its entirety at the time, but she plans to do so in the near future. Twelve lighting recipes were actually completed, however. Six existing lamps were rebuilt, two new lamps added, and two outside lighting units installed. By properly relamping existing fixtures and portable lamps, 1,130 w were added to the existing 935 w to make a total of 2,065 connected watts for lighting.

As a result of this lighting program—a test operation designed by Ebasco Services, Inc, for General Electric Co's Lamp Division—we believe we are making progress in cracking the existing market for better wiring in the residences we serve and increasing our load as well.

Contractors Offer $99.50 Wiring Package

Four electrical contractors of Baraboo, Wis., are offering a package wiring modernization deal for $99.50. It includes: New No. 2, three-wire, 100-amp service; switch panel with ten 115-v branch circuits; provisions for easy connection of electric range and dryer; complete connection of the customer's present wiring system to new installation. Those in on program are: J. Benardis, J. Benardis Electric Co; Ervin Giese, Erv's Electric Shop; Max Hill, Hill Electric Co; and A. C. Jensen, manager, Sears Roebuck & Co. Deal is promoted through cooperative advertising sponsored by the contractors and Wisconsin Power & Light Co. Display board plugging package is being rotated in the different stores. It also was displayed at a Baraboo bank with a man in attendance to tell the story. Interest shown so far has been heartening, and contractors say number of jobs already sold offer real promise.

Got a Good AW Program? You Can Win a Prize

Look Magazine again this year will honor the electric utility company it feels is doing the best job of promoting adequate wiring.

Utilities are now being invited to submit entries. Winner will be presented with a community service award trophy at the 13th annual National Adequate Wiring Bureau Conference in Chicago, Feb. 23-24.

Each entry should consist of a presentation including such material as advertising tear sheets, pictures of store and outdoor display, descriptions of TV and radio campaigns, and evidence of cooperation with local electrical industry groups, home builders and architects, etc. All entries must be postmarked not later than Feb. 1. Address them to: Adequate Wiring Competition, Look Magazine, 488 Madison Ave, New York 22, N. Y.

The competition was staged for the first time last year. The magazine now plans to make it an annual event. Similar competitions also are being conducted among appliance dealers, electrical contractors, and distributors.

VICTOR "Know-How"...

Gives You Purified Porcelain Suspensions...

America's Finest

VICTOR NO. 924
(EEI-NEMA TDJ-52-5)
25,000 LB. SUSPENSION
INSULATOR

VICTOR *Purified* Porcelain suspension insulators are laboratory designed to make them the finest in their field. VICTOR'S complete testing facilities, which include the industry's most modern impulse generator, certify to the soundness of their design.

Take the 25,000 lb. unit shown above, for example. It has rugged, rounded corrugations for maximum strength and resistance to impact. Cap and ball bolt, built to the most rigid specifications, are thick, husky and double-dip galvanized to withstand the severe service for which this insulator was designed. Scientifically fitted glaze, properly and uniformly applied, gives added strength . . . added protection against contamination. Each insulator is proof-tested mechanically, then subjected to vigorous high frequency and 60-cycle flashover tests. You just can't buy a better suspension!

SPECIFICATIONS

60-cycle dry flashover	80 KV
60-cycle wet flashover	50 KV
Positive impulse flashover*	125 KV
Negative impulse flashover*	130 KV
Dry arcing distance	7¾"
Leakage distance	11"
M and E strength	25,000 lbs.
Impact rating	60 in. lbs.
RNI	50 Microvolts
1000 KC at applied	10 KV

*Crest KV, 1½ x 40 microsecond wave Critical Value.

NEWS FROM VICTOR

These two booklets—"The Story of Victor" and Bulletin No. 4—contain a wealth of insulator information that has proved of tremendous interest to thousands of power men throughout the nation. If you do not have both in your files, ready for instant reference, send for them today.

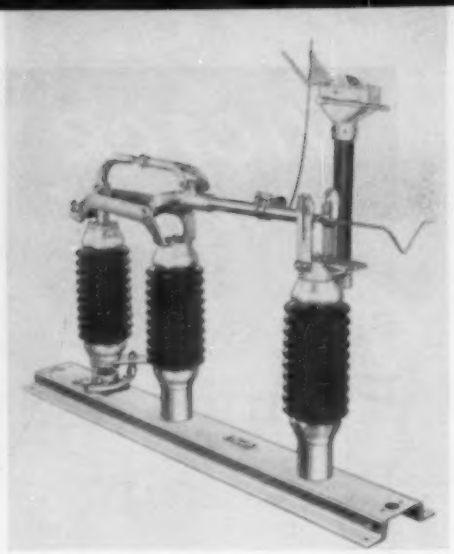
SPECIFY VICTOR Purified Porcelain Suspensions!

VICTOR INSULATORS DIVISION
I-T-E CIRCUIT BREAKER CO.
VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains
Spools • Switch and Bus Insulators • Custom Designed Porcelain
Insulator Hardware

NEW EQUIPMENT

Full Load Interrupter Switch

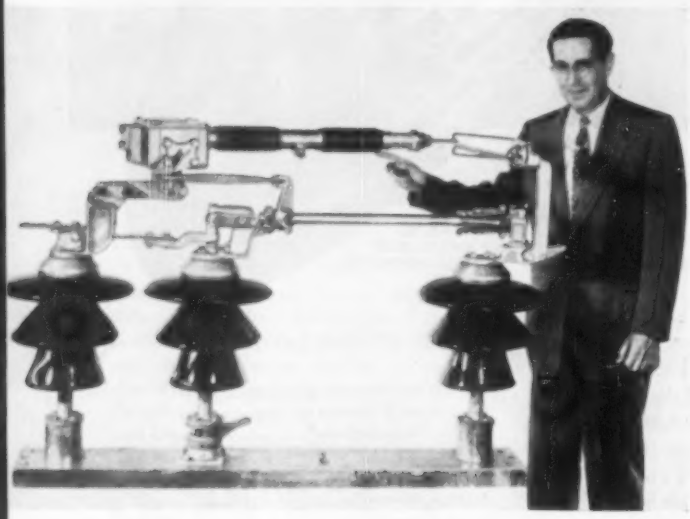


These outdoor, vertical-break, rotating-insulator, high-pressure-contact Lodrupter switches (Types TRE) are equipped with a single, multi-gap interrupter unit capable of interrupting full load current up to 46 kv. They are reported well suited for switching high-voltage capacitor banks. Switch illustrated is rated 34.5 kv, 600 amp, continuous and interrupting duty.

All arcing and flame during circuit interruption is confined within the interrupter unit to eliminate hazards of phase-to-phase and phase-to-ground arcovers. The switch may be operated manually or with any standard power-operated mechanism.

These switches are available for standard voltages from 7.5 to 46 kv.

I-T-E Circuit Breaker Co, R&IE Equipment Division, Greensburg, Pa.



Interrupter Switch

An outdoor switch (BF 21) with a dry-type interrupter unit offers constant high speed interruption in one cycle or less.

Contact speed is independent of the switch's operating time on both opening and closing. Interruption takes place entirely within the arcing chamber. Here the arc is confined and extinguished by pressure and blast of gases produced from dry solid material. No oil or air blast is required.

Overloads cannot damage the interrupter unit as it is out of the circuit when the switch is closed, the manufacturer reports. The BF 21 is now offered in units through 46 kv and will be available up to 115 kv.

Electrical Engineers Equipment Co, Melrose Park, Ill.

Interference Locator

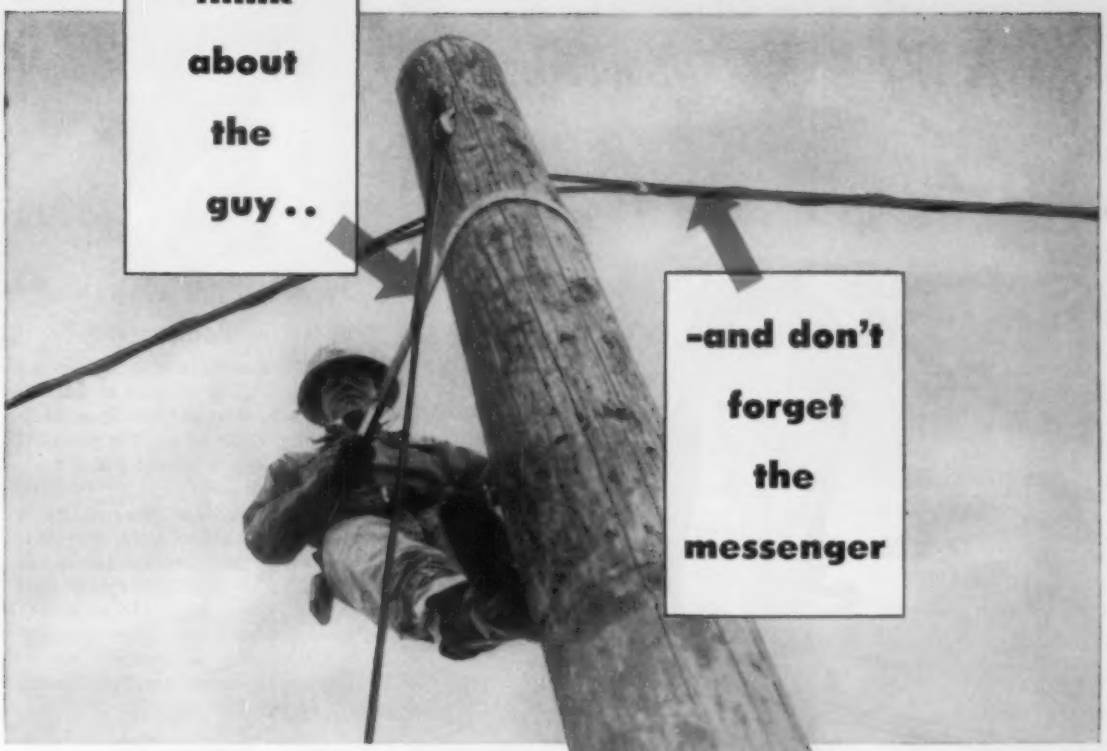
This portable instrument is designed for rapid location of radio and TV interference sources. It is also reported useful in preventive maintenance programs, since many faults emit radio noise before actual failure occurs.

Model 400 interference locator has a frequency range from 500 kc to 220 Mc in six bands. It is powered from either a 117-v, 60-cycle external supply or by a self-contained rechargeable wet cell. A battery-charger is built into the unit for overnight recharging.

The unit is 7¼ in. deep, 10¾ in. wide, 13½ in. high and weighs 28 lb. A complete set of accessory items is available. For further data write for Form MD-7005.

Sprague Electric Co, North Adams, Mass.

(More New Equipment on page 118)



In the selection of strand for your guys and messengers, consider all the factors and you'll realize the true economy of Copperweld* Strand. It's the only strand that provides both the strength of steel and the corrosion resistance of copper. That means you'll have safe, strong, low-cost support for the entire life of your lines. You can forget about repair and replacement costs because once Copperweld Strand is up, it's up to stay. Try it on your next job. It pays!

*Trade Mark

COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION
Glassport, Pa.
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

Copperweld TRADE MARK non-rusting Strand

for GUYS AND MESSENGERS

PORCELAIN PRODUCTS' Service Mast KIT

MAKES INSTALLATION FASTER...EASIER

STANDARD FOR 2" PIPE

Also available FOR 2½" PIPE

EVERYTHING FURNISHED

but the house and conduit

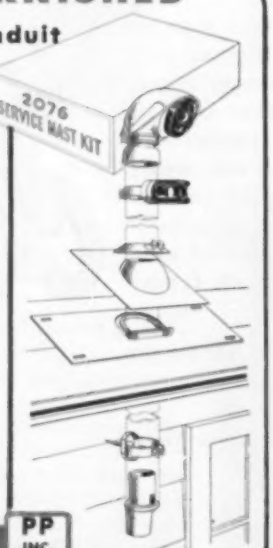
Here is the *only* Service Entrance Mast Kit complete in every detail—including roof flashing—even necessary bolts, nuts, lag screws and nails. Can be *installed* by an *electrician, with electricians tools.*

Cut down installation costs with these easier, quicker to install, service entrance mast kits.

Here is a complete list of the parts you'll find in this Porcelain Products' Service Mast Kit.

- √UL approved Service Entrance Cap and Bell Reducer
- √Galvanized Roof Flashing and Storm Collar
- √Roof Mounting Plate of new and original design
- √Conduit hanger with 2¼" lag screw attached
- √Slip-fitting offset reducer with interior grounding device
- √All necessary bolts, nuts, lag screws and nails
- √Plus—Porcelain Products' famous 2061-C Pipe Mounting house brackets as specified

WRITE FOR DETAILS TODAY!



ELECTRICAL PORCELAIN SINCE 1894

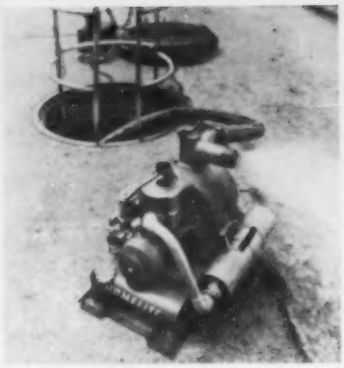
61 Years

Porcelain Products, Inc.

FINDLAY, OHIO

PP INC.

CATALOG NO.
2075 — NO WIREHOLDERS
2076 — 1 WIREHOLDER
2077 — 2 WIREHOLDERS
2078 — 3 WIREHOLDERS



Portable Pump

This self-priming, centrifugal pump (Model 36S2) is designed to work at a low noise level and slow speed while pumping 9,000 gal/hr. The pump has a 28-ft suction lift and 65-ft total head, including friction.

These units are powered by a single-cylinder, air-cooled, two-cycle gasoline engine governed for speeds between 2,550 and 2,650 rpm at open throttle. The pump can be reduced to quiet speeds between 1,200 and 1,500 rpm by closing the throttle.

Homelite, Riverdale Ave, Port Chester, N. Y.

Service Entrance Kit

A complete kit is being offered for residential service entrance. It consists of an entrance head with slip-fitter adapter, a roof flange, mounting brackets for the mast and an adapter for the meter connection.

(*Continued on page* 122)

FACT:

Versatility, economy of Type A recorders help you establish greater system efficiencies

Dependable Westinghouse Type A recorders have gained wide acceptance by utilities for making load surveys. Industry has found them ideal for checking machine operation and factory distribution systems.

FACT: Low Cost—your recording costs are low with the Type A because it is simplified, easy to service . . . maintenance costs are kept to a minimum. The Type A is also low in initial cost . . . you can use it freely whenever, wherever you wish.

FACT: Dependable—high-torque mechanisms give you maximum operating stability under the most severe conditions. Pen friction is decreased, energy consumption is low, precise leveling is unnecessary.

FACT: Versatile—Westinghouse Type A recorders are available in five types to meet your every need for low-cost recording of a-c and d-c voltage and current: portable, switchboard flush, switchboard projection, wall mounting, socket mounting.

You can be sure of accurate recordings or indications of electrical values, whatever the application, when you specify Westinghouse instruments.

• • •

FOR MORE FACTS: Call *The Man With The Facts* . . . your Westinghouse sales engineer. Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-40465

YOU CAN BE **SURE**...IF IT'S

Westinghouse

GUY FIXTURES

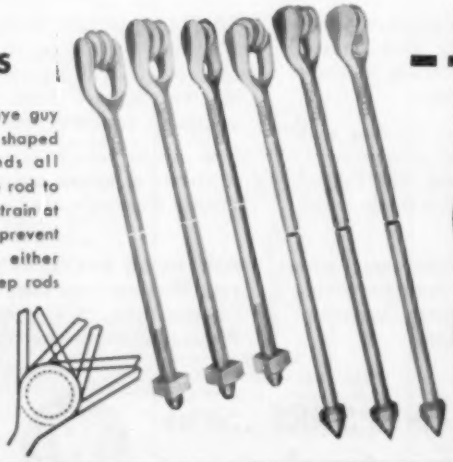
You can save time by making up guys on the ground, save and protect guy strand by using Chance guy fixtures. The full-rounded Thimbleye gives complete strand protection at any angle of pull during slack pulling operations and when in use. Chance fixtures are drop forged from high grade steel, and are heavily galvanized. The line includes Straight and Angle Thimbleye Bolts, Angle Thimbleyes, Thimbleye Nuts, Straight Away and Down Guy Loops, Guy Wire Clips, Curved Washers and Plates.

GUY GUARDS

Only Chance offers such a complete line of guy guards: The SURE-GRIP, with no loose parts to lose—nothing to take apart and re-assemble. The MONO-BOLT, that combines safety, durability and economy with simple installation—only one nut to tighten. The MATTHEWS, a one-piece protector that bolts to the guy clamp and that cannot turn or twist when installed.

GUY RODS

Choose Chance Thimbleye guy rods—with the perfectly shaped "thimble" that extends all around the head of the rod to protect the cable from strain at any angle of pull and prevent kinking. You can get either threaded or Never-Creep rods with Thimbleye, Twin-eye, or Tripleye heads for use with one, two, or three guy strands.



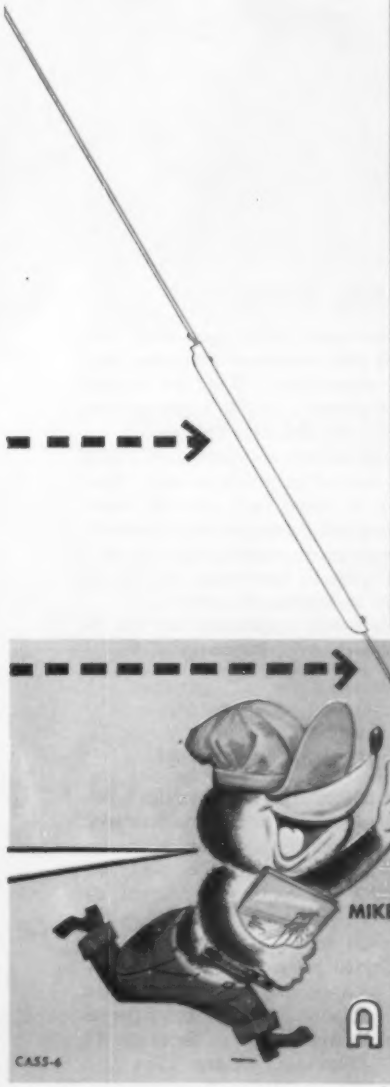
Man... this book can help you "dig" anchors better ... get yours TODAY!

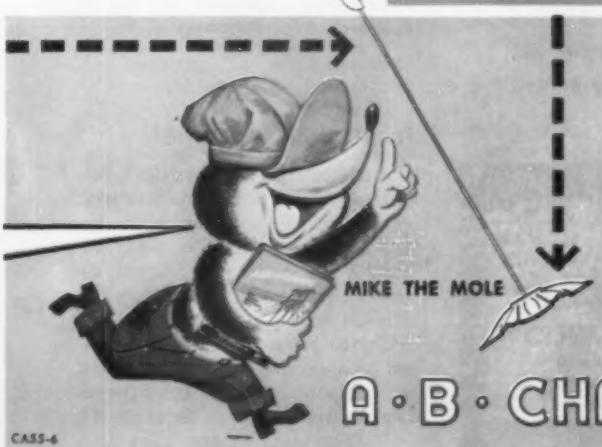
Give the GUY a CHANCE

FOR THE BEST IN GUYING

Look to Chance for *all* your guying needs . . . everything but the guy strand. You can equip your crews with Chance anchor installing tools *designed* for better, faster anchor installations . . . you can choose an anchor for every soil or guying condition from this most complete line of anchors in the industry . . . add years to guy strand life with the full-rounded Thimbleye on Chance guy rods and fittings . . . select the guy guard to fit the job . . . and finish the job with Chance Guy Fixtures on the pole. You can get 'em all from one source—your Chance Distributor. For fast service plus the *best* in guying—*give the GUY a CHANCE!*

GUY ANCHORS





Here is the most complete guide to better anchoring ever developed. It's chock full of how-to-do-it material to help you select the *right* anchor for every guying job and install it properly. It's FREE!

A·B·CHANCE CO. CENTRALIA MISSOURI

SAN FRANCISCO, CAL.

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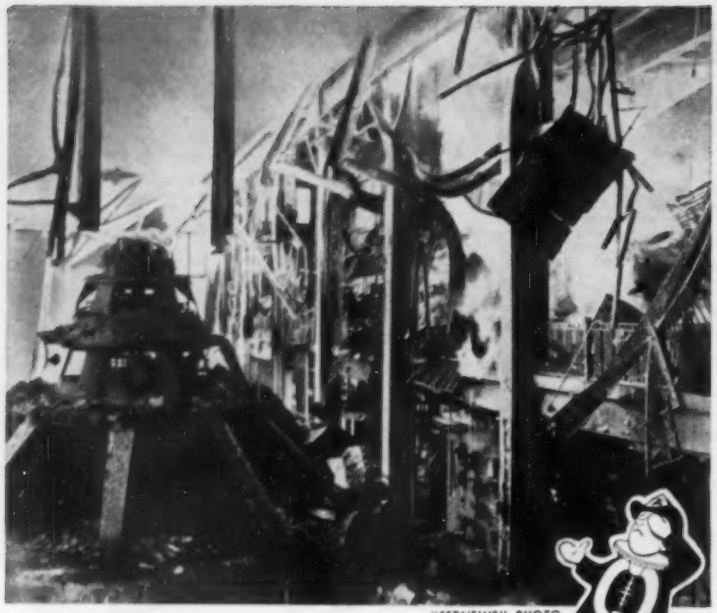


"FEDNEWS" PHOTO

Let There Be Light-

Sorry — we're out of business today, and for many days. We've been forced to cut "interruptable" customers. Total loss in fire damage and power may exceed 10 million dollars.

Here's what happened. Fire started in a circuit breaker and spread throughout the building. The roof crashed down. Giant steel beams sagged like ribbons. Concrete walls fell into the machinery. Engineers and repair crews are restoring our power output, but it will take time and plenty of money.

Moral: Prevent damage to equipment and interruption of power service with ENGINEERED "Automatic" FIRE PROTECTION. It involves analyses of your needs based on the machinery and equipment connected with your operation. Your hazard may best be protected by means of "Automatic" FIRE-FOG, AIR FOAM, CO_2 or a combination of these extinguishing mediums. The need is dictated by the degree of hazard, the demand for personnel safety, the high value of equipment, the requirements for uninterrupted business operations.

Learn how ENGINEERED "Automatic" FIRE PROTECTION can safeguard your plant — save you dollars while doing it. Mail the coupon for FREE descriptive literature.

"Automatic" Sprinkler Corp. of Amer.
Youngstown, Ohio

Please rush copy of Bulletin 64 — Design and Application of "Automatic" FIRE-FOG

Name_____

Title_____

Company_____

Address_____

City_____ State_____

"Automatic" Sprinkler
CORPORATION OF AMERICA
YOUNGSTOWN, OHIO
Offices in principal cities of North and South America

New Equipment

(*Continued from page* 118)

The kit is made for use with either a 2-in. or 2½-in. mast and one or more pipe clamp wireholders.

Roof-top periscopes like this are used on low roofs to prevent accident hazards.

Hubbard & Co, 6301 Butler St, Pittsburgh 1, Pa.

Safety Helmet

Redesigned Shockgard safety helmets offer increased protection, says the manufacturer. They are reported to withstand a 40 ft-lb impact without losing any dielectric strength.

The helmets are made from a plastic material in yellow or gray. They have no metal parts and are impervious to oil, grease and most chemicals. A snap-in suspension adjusts to fit a full range of head sizes. Details are given in Bulletin No. 0607-2.

Mine Safety Appliances Co, 201 N. Braddock Ave., Pittsburgh 8, Pa.

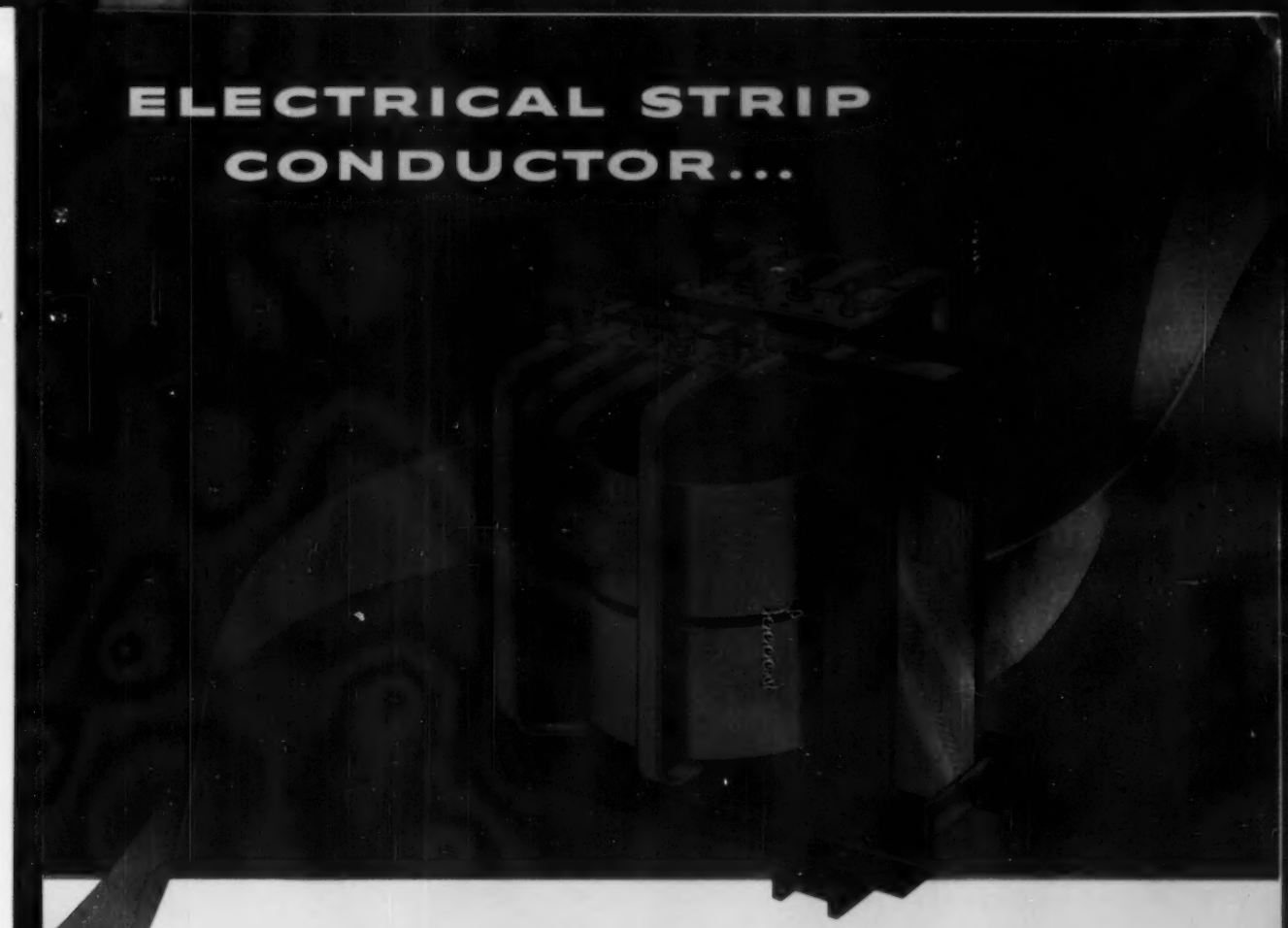
Insulation Machine

A machine is available that automatically forms and inserts insulation in all toothed stators up to 30 hp. The machine is said to be easily adjustable to stators of different diameters, different number of slots and different depths.

Geared powered rolls feed the paper to a die that cuts off and forms the insulation. A finger strips the insulation from the form die as the die

(*Continued on page* 125)

ELECTRICAL STRIP CONDUCTOR...



A Completely NEW Idea in Transformers ... Developed by Reynolds

"In the electrical equipment industry, there have been tremendous advances over the years, but in the conductor itself, this development by Reynolds is the first major improvement." These are the words of an official with one of the leading electrical equipment manufacturers who worked with Reynolds to bring about an electrical revolution . . . a revolution that means *less weight, less cost, and simplified production* in transformer and other coils of the future.

In this new development aluminum becomes both an efficient conductor and an effective insulator. Naturally formed aluminum oxide is non-conductive. Through anodizing this oxide film can be deepened sufficiently for insulation in many electrical applications. For the new type coil windings, anodized aluminum strip provides added conductive area without increasing the space now required for copper wire. Space taken up by insulation and voids in copper wire coils is eliminated.

Heat dissipation is greatly improved in aluminum strip coils because each winding is externally exposed and because of aluminum's high heat transfer characteristics. Hot spots are eliminated. Cooling ducts usually aren't needed. And anodized aluminum insulation is not susceptible to the deterioration of conventional organic types.

The services of Reynolds engineers are available to your staff in considering the application of anodized aluminum strip windings to your electrical products. However, production quantities are not yet available. For samples of Reynolds Aluminum Strip Conductor and for technical assistance on applications call the Reynolds office listed under "Aluminum" in your classified telephone directory. Or write *Reynolds Metals Co., P. O. Box 1800-EV, Louisville 1, Ky.*

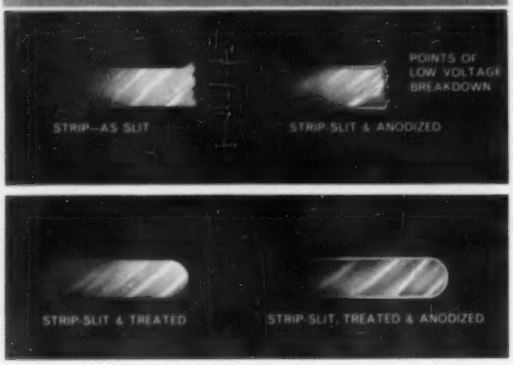
See Reynolds New Program "Frontier"—Sundays on NBC-TV

REYNOLDS ALUMINUM

MORE INFORMATION ON FOLLOWING PAGE →

ADDITIONAL DATA ON REYNOLDS ALUMINUM STRIP CONDUCTOR

FABRICATION PROCESS

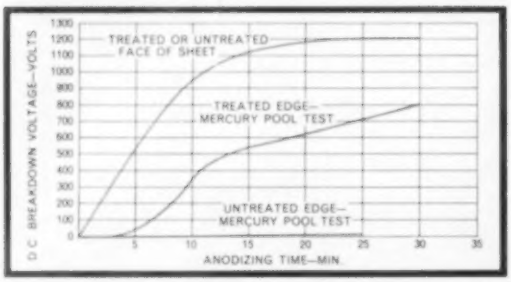


The insulation for Reynolds Aluminum Strip Conductor is provided by a comparatively thin anodic film. Since it is impossible to get a uniform anodized coating on the irregular edge of standard strip (top), Reynolds modifies the cross sectional shape (bottom) by a combination of chemical and mechanical treatments. It is on this operation that the major patent application claims are based.

EFFECTS OF BENDING

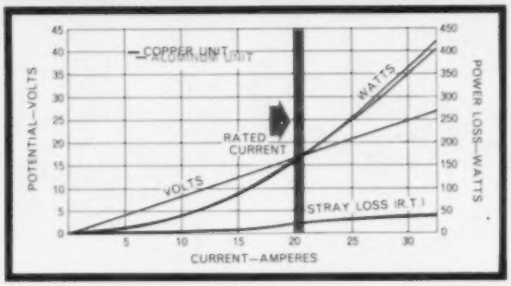
In spite of its relatively hard, inelastic anodized film, Reynolds Aluminum Strip Conductor is bent without film fractures. This permits winding transformer and other coils without voids that may occupy 25% of the space in a conventional wire wound coil. Bulky organic insulation is also eliminated.

INSULATION EFFICIENCY


D.C. BREAKDOWN VOLTAGE—VOLTS
TREATED OR UNTREATED FACE OF SHEET
TREATED EDGE— MERCURY POOL TEST
UNTREATED EDGE— MERCURY POOL TEST
ANODIZING TIME—MIN.

Even a relatively short anodizing time of 8 to 10 minutes gives Reynolds Aluminum Strip Conductor a dc breakdown rating of 300 to 400 volts. With two faces adjacent, a layer to layer breakdown rating of 600 to 800 volts is obtained . . . several hundred times the rating required for the turn to turn voltage difference in transformer windings.

CONDUCTOR LOSS AND IMPEDANCE



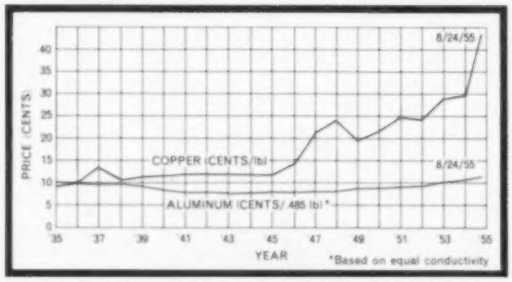
Graph shows how electrical characteristics of a 10 kva copper wire wound transformer are virtually duplicated by a transformer with Reynolds Aluminum Strip Conductor wound in exactly the same physical space as conventional copper coils.

WEIGHT AND COST

COILS:	SQUARE COPPER DOUBLE GLASS INSULATION	ALUMINUM ANODIZED FILM INSULATION
CONDUCTOR SIZE		
PRIMARY	1—.46 GA	1—.008 x 3%
SECONDARY	2—.46 GA	2—.008 x 3%
TURNS:		
PRIMARY	2 COILS—84 TURNS	2 COILS—84 TURNS
SECONDARY	2 COILS—42 TURNS	2 COILS—42 TURNS
COIL WEIGHT	41 lbs	20 lbs
PRICE $/lb	$0.77	
CONDUCTOR COST, $	$31.57	APPROX. 50%
CORE (SHELL TYPE)		
WEIGHT	132 lbs	132 lbs
CROSS-SECTIONAL AREA		
CENTER SECTION	14.625 in.²	14.625 in.²
YOKE	20 in.²	20 in.²

Here is a comparison of 10 kva—480/240—240/120 transformers of conventional copper design and with Reynolds Aluminum Strip Conductor in exactly the same physical space. Note that aluminum strip design saves approximately half the conductor cost and weight.

PRICE TREND



The trend of copper and aluminum prices over the past 20 years is not only an important factor in Reynolds Aluminum Strip Conductor but also in the selection of Reynolds ACSR, Reynolds Covered Conductor, RABC (Reynolds Aluminum Bus Conductor) and Reynolds Aluminum mill products for other electrical applications and equipment. Reynolds engineers will be glad to help apply aluminum's cost and other advantages to your electrical conductor uses. *Reynolds Metals Company, P. O. Box 1800-EV, Louisville 1, Kentucky.*

REYNOLDS ALUMINUM

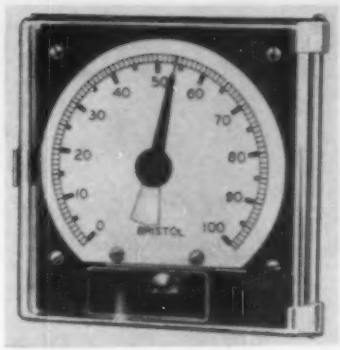
MODERN DESIGN HAS ALUMINUM IN MIND

New Equipment

(*Continued from page* 122)

opens and pushes it through a necking guide into the stator. Cuffs in the paper are formed in the feed rolls. These cuffs expand out locating the insulation securely in the stator. The stator is automatically indexed to the next slot. When all slots are filled, the machine stops.

Hautau Engineering Co, 721 Wanda, Ferndale, Mich.



Telemeter Receivers

Miniaturized Metameter telemeter receivers are available for graphic panel arrangements. Meters can be used to receive telemetered signals such as pressure, temperature, voltage or current.

These units are available either as indicators or strip-chart recorders. They occupy a panel space only 5 in. square. Details are given in Bulletin No. M1710.

Bristol Co, Waterbury 20, Conn.

Speed Controls

Complete 1 and 1½-hp Variac motor speed controls are available for forward, reverse and stop operations. The controller and speed-adjusting Variac are separate from the main chassis for remote installation.

A dynamic braking resistor is included for use where quick stopping is required. Overload protection of the Klixon type with appropriate time-delay characteristics is incorporated in the Variac.

General Radio Co, 275 Massachusetts Ave, Cambridge 39, Mass.

(*More New Equipment on page* 128)

HERE'S an Employee who.....
Requires no pay check
Works 24 hours a day
Never makes a mistake
Never takes a vacation
Never wastes time
DIAMOND
INDUSTRIAL
(WIRED)
TELEVISION
UTILISCOPE
"UTILISCOPE"
for special applications
in heavy industry
"UTILIVUE"
distributed by Graybar
Diamond Industrial Television has become an indispensable "employee" in many plants in a wide variety of industries. In their search for improved operation and lower costs, these companies have found the Diamond "Utiliscope" or "UtiliVue" the best answer to numerous problems. You, too, can probably use Diamond ITV to substantial advantage. For case histories and suggestions, return the coupon today.
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OFFICES IN 39 PRINCIPAL CITIES
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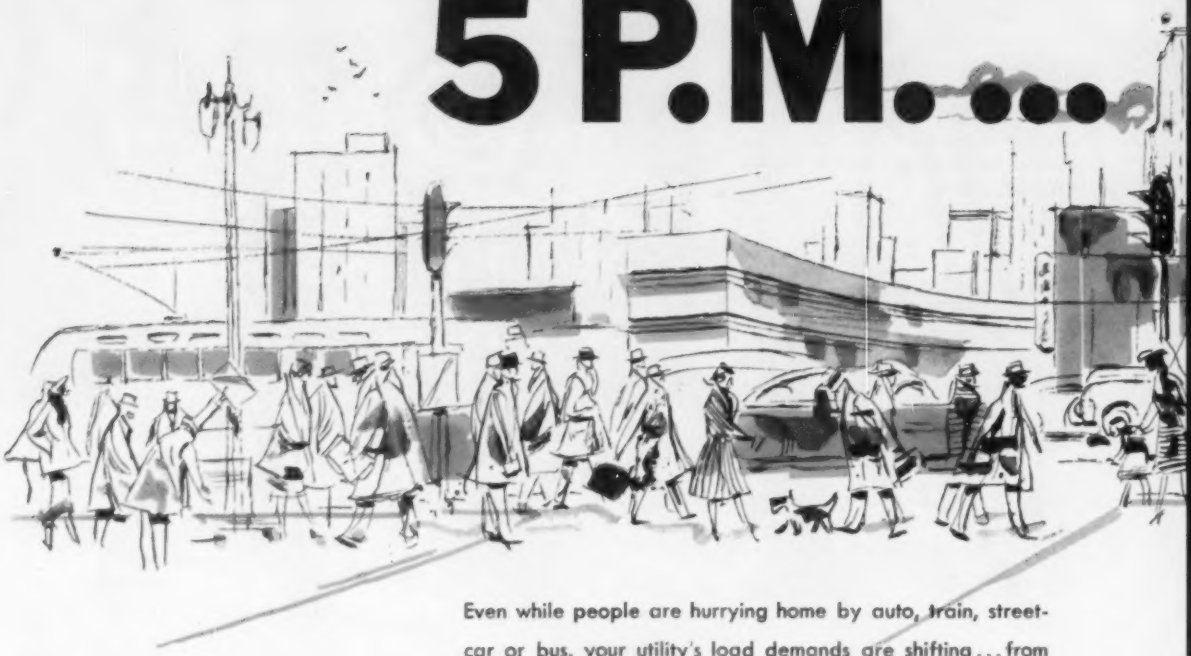
ELECTRONICS DEPT., P. O. BOX 415KK
LANCASTER ,OHIO
Please send me without obligation a copy of new bulletin showing how Diamond Industrial (Wired) Television will help me reduce costs, improve quality, increase sales and aid safety.
Name
Company
Address

5 P.M....



Even while people are hurrying home by auto, train, streetcar or bus, your utility's load demands are shifting... from industrial and business areas to residential areas.

With Moloney Load Tap Changing Transformers, your utility system can dependably handle shifting load demands... because Moloney LTC equipment provides trouble-free voltage regulation... under all operating conditions.

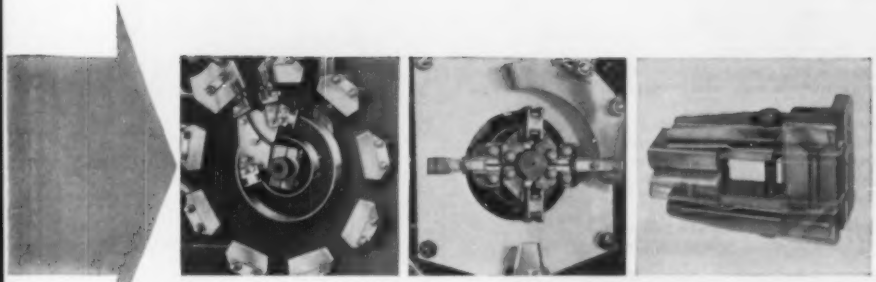
Every step of the way, from plans to performance, Moloney LTC equipment is skillfully engineered and carefully fabricated to provide dependable performance... for your utility system.

ME-55-53

M O L O N E Y E L E C T •

Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers
Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT



Moloney's exclusive by-pass reactor principal—used for all Kva and voltage ratings—permits regulation of voltage *without* arcing at Tap Selector Switch (left) because *all* current interrupting duty is performed by Load Transfer Switch (center). Arcing at Load Transfer Switch is minimized by a reactor in parallel with the Load Transfer Switch. Contacts (right) used for current interrupting duty are tipped with a high arc-resistant, copper-tungsten alloy to minimize arc deterioration and maintenance costs.

Specify Moloney . . . Get Dependability at its Best . . . All Along the Line

R I C C O M P A N Y

Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation
Industrial Dry Type Transformers • Capacitors • Magnetic Components for Electronics

ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

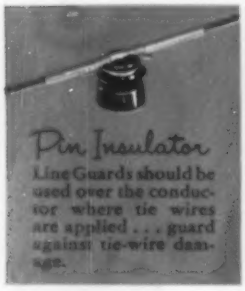
MOLONEY ELECTRIC

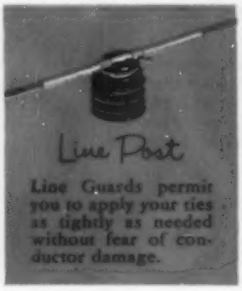
• Preformed Line Guards will save money on short-span urban distribution lines . . . whether ACSR, all-aluminum, or copper conductors are in use. Use them on all conductors where protection against vibration damage is not essential and standard Armor Rods may not be needed. Line Guards are smaller in diameter—fit insulator grooves of both old and new designs. Check P L P price lists. You will notice Line Guards are *lower* in price than Armor Rods . . . yet, Line Guards provide sufficient protection on short spans.

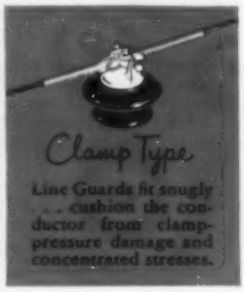
Line Guards . . . developed from Armor Rods—are used like Armor Rods . . . protecting conductors against arcover, chafing, and mechanical wear due to concentrated stresses on light or short-span construction.

Let your P L P Representative help you select the most economical P L P Product for your application. Write or call Cleveland: EX 1-3571.

**Made in accordance with or for use under one or more of the following U. S. Patents: 2,275,019; 2,587,521; 2,609,653; 2,691,865; other patents pending.*



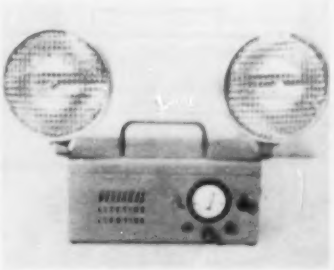




PREFORMED LINE PRODUCTS CO.
5349 St. Clair Avenue
Cleveland 3, Ohio

Emergency Lighting Unit

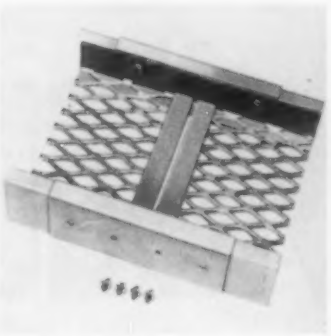
An emergency lighting unit turns on automatically when power fails and rapidly restores full battery energy once power is resumed, the manufacturer reports. Hermetically sealed nickel-cadmium battery is said to furnish many years of service with no maintenance.



The unit is 17 in. long, 7 in. wide and 11½ in. high. It weighs 13.5 lb.

Unit mounted lamp assemblies or with power supply remotely located for multiple lamp installations are available. Terminal boards, ac power cords, switches and automatic operation are included. For full information write for Bulletins A46 and A71.

Dynaseal Lighting Corp, 5 Hadley St, Cambridge 40, Mass.



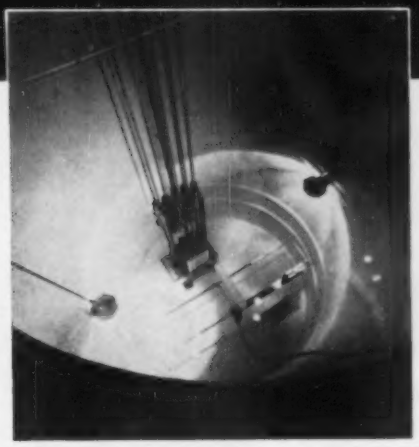
Cable Supports

Trough, ladder and channel supports for cable and tubing have channel connectors with drive rivets for quick assembly and added strength, the manufacturer reports.

Cutting and drilling in the field are said to be eliminated by use of various lengths of trough up to 16 ft and extension connectors. For more data request Bulletin No. 855.

P-W Industries, Inc, 4500 E. Melrose St, Philadelphia 24, Pa.

(*More New Equipment on page* 132)



Here's what the onlooker sees when he gazes down into the Reactor's 20-ft deep "swimming pool." (Both photos courtesy U. S. A.E.C. and Union Carbide And Carbon Corp.)

Prominent among United States exhibits at the recent "Atoms for Peace" Conference, in Geneva, Switzerland, was the Research Reactor shown above. Like other research and proto-type power-producing reactors in this country and abroad, this Reactor incorporates Leeds & Northrup nuclear instrumentation. The five Speedomax recorders, in the main control panel, chart all control functions, while the L&N Servo Amplifier and Micro-micro-ammeter automatically control the Reactor when it operates at full power level.

Leeds & Northrup Company is staffed and equipped to service all of your reactor control requirements. Send for our brochure, "Control Systems for Nuclear Reactors." The address—Leeds & Northrup Co., 4938 Stenton Ave., Phila. 44, Pa.

LEEDS NORTHRUP
instruments automatic controls • furnaces

Suppliers Check...But Allis- to Assure

ALLIS-CHALMERS
POWER
Transformers

Suppliers Meet Rigid Specifications which are set by Allis-Chalmers engineers and checked by personal visits to supplier plants. Even so, additional tests are made when insulating material arrives at an A-C transformer plant. It is first checked visually and checked with micrometer to make sure exact dimensional requirements have been met.

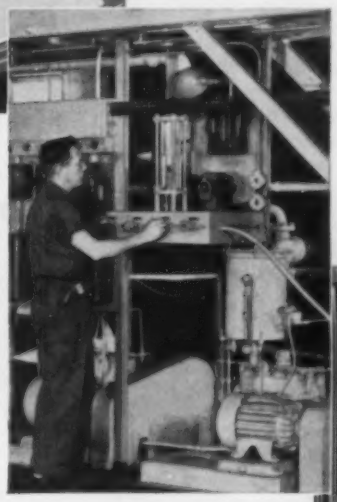
Random Samples are Carefully Analyzed before stocking. At left, breakdown test determines whether material meets requirements. Center, power factor test is being made on Kraft paper. Other tests include tests for aging, flexibility, and oil proofness. At right, an insulating rod is being checked for tensile strength before the shipment is sent to stock. If all or part of a shipment fails to meet any of these tests, it may be returned to the supplier immediately.

For information on these or other Allis-Chalmers double-checks for transformer quality, call the A-C office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4763

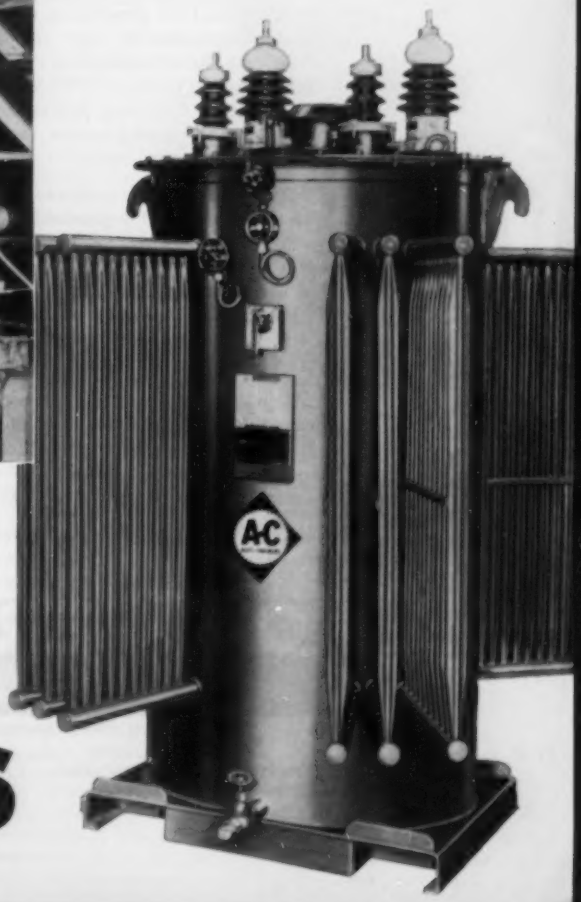
ALLIS-

Chalmers Double Checks Insulation Quality

Utmost Dielectric Strength is Assured through use of degassed oil. Above, power factor test is made after transformer is tanked. Finally, below, completed transformer is given standard NEMA and ASA dielectric tests.



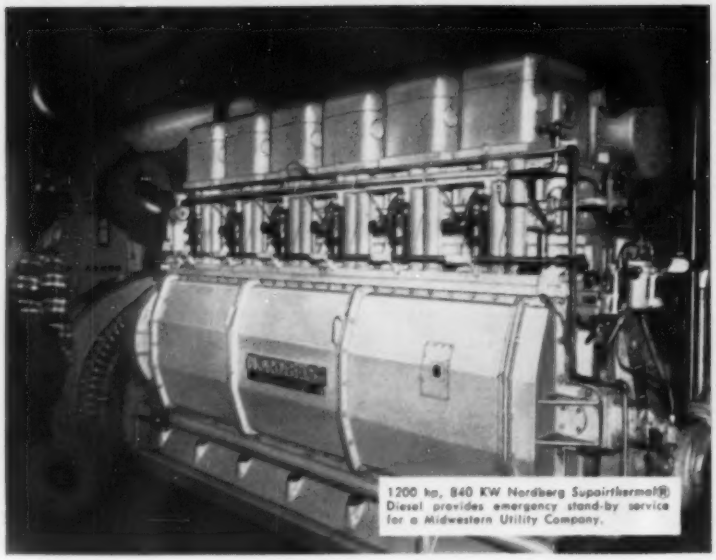
Tests Continue During Manufacture. Above: Insulation resistance tests are made on windings in oven before assembly is begun. After assembly, before it is immersed in oil, further resistance and power factor tests are made.



Oil is Degassed to secure thorough impregnation of insulation in special degassing equipment shown above. Oil is heated, sprayed into a vacuum chamber by high pressure jets which atomize it. Air dissolved in oil is then removed by low vacuum.

A-C ALLIS-CHALMERS

CHALMERS


1200 hp, 840 KW Nordberg Supairthermal® Diesel provides emergency stand-by service for a Midwestern Utility Company.

NORDBERG DIESELS
Pay Extra Dividends for Peaking and Standby Service

If lack of sufficient power makes it difficult to hold peak load generating costs "down" and standby dependability "up"—it will pay you to investigate the advantages of Nordberg engines. These efficient prime movers are easily installed independent of existing power facilities, go on the line quickly and generate low cost power under all load conditions.

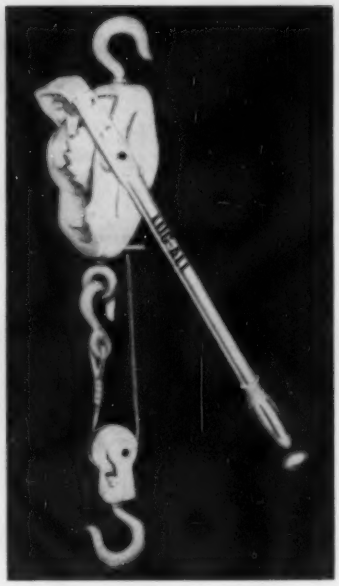
Many utilities have assigned their standby power problems to dependable Nordberg engines. In doing so, these modern companies have found them also exceptionally economical for "topping the load" or firming line voltage in outlying areas. This is a sound investment and dividends are paid in the form of increased dependability and economy and more desirable operating flexibility.

As builder of America's largest line of heavy duty engines, Nordberg offers specialized experience second to none, in helping to find the most dependable, economical solution to your specific power problem. Write for further information.

NORDBERG MFG. CO., Milwaukee, Wisconsin

NORDBERG
DIESEL • DUAFUEL® AND SPARK IGNITION GAS ENGINES
© 1955, Nordberg Mfg. Co. P455

AMERICA'S LARGEST HEAVY DUTY ENGINE LINE . . . 10 to over 12,000 H.P.



Winch-Hoist

This lightweight winch-hoist with 20 ft of cable lifts, lowers or pulls 2 tons a distance of 10 ft when used double cable (illustrated), or 1 ton 20 ft when used single cable.

To prevent accidents, the "safety handle" bends before the units can be overloaded. An interlocking pawl system securely locks the load. These units weigh 15 lb.

Lug All Co, Haverford, Pa.

MORE NEW PRODUCTS

Kimble Glass Co, Box 1035, Toledo 1, Ohio, has a **communications insulator** (Hemingray TS-23) for carrier circuit use on all "point" type transposition hardware and at intervening non-transposition poles.

Huenefeld Co, 2701 Spring Grove Ave, Cincinnati 25, Ohio offers the Boss line of **electrical cutout boxes,** pull boxes, transformer cabinets, and custom-built electrical enclosures. Write for Catalog No. CB 4.

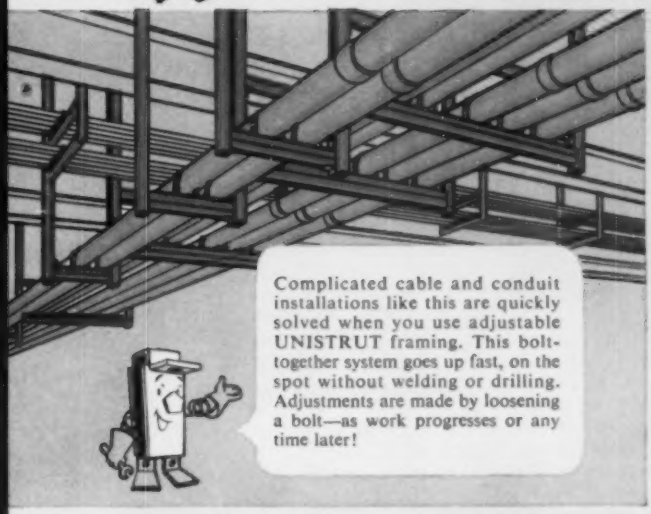
W. H. Brady Co, 727 W. Glendale Ave, Milwaukee 12, Wis., has developed a self-sticking **conduit and voltage marker** for electrical circuits and equipment. Markers are made of non-conductive cotton cloth, with bold, black lettering on an orange background.

(*Continued on page* 134)

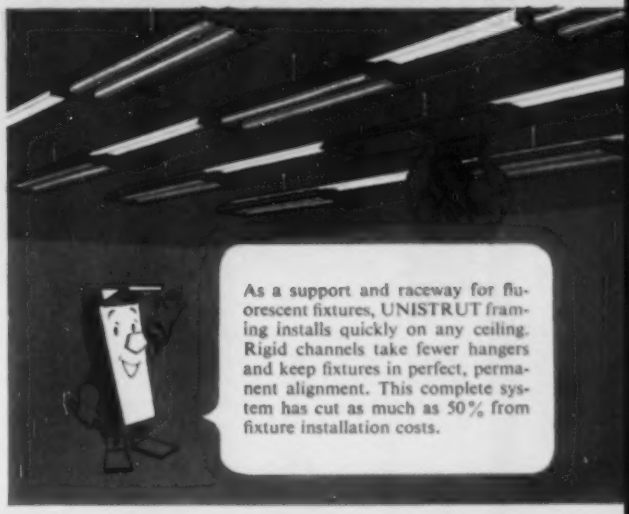
"The Sky's The Limit"

—when you build with UNISTRUT®

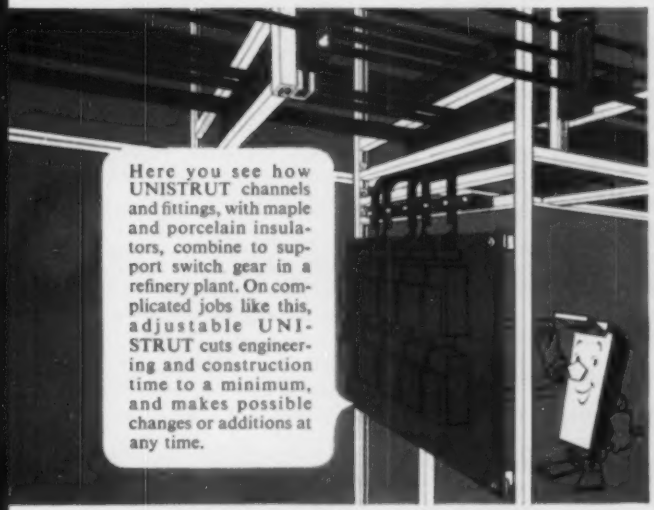
Mr. Strut shows how flexible UNISTRUT® framing saves time and dollars on electrical supports



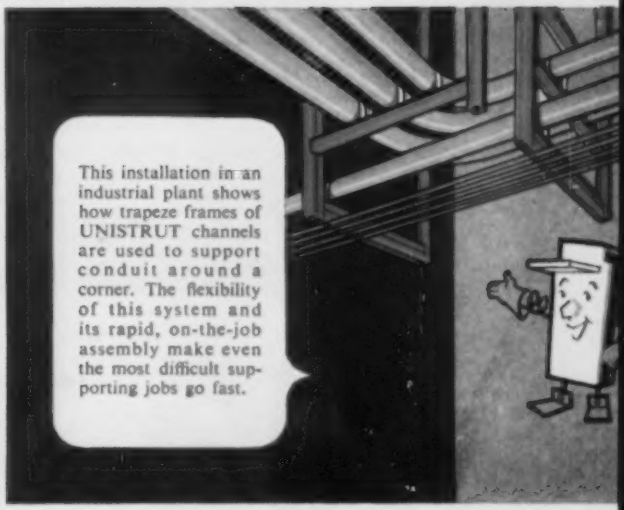
Complicated cable and conduit installations like this are quickly solved when you use adjustable UNISTRUT framing. This bolt-together system goes up fast, on the spot without welding or drilling. Adjustments are made by loosening a bolt—as work progresses or any time later!



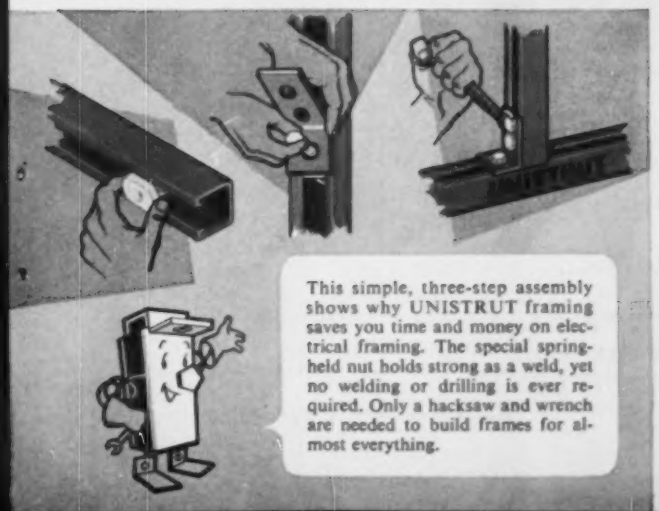
As a support and raceway for fluorescent fixtures, UNISTRUT framing installs quickly on any ceiling. Rigid channels take fewer hangers and keep fixtures in perfect, permanent alignment. This complete system has cut as much as 50% from fixture installation costs.



Here you see how UNISTRUT channels and fittings, with maple and porcelain insulators, combine to support switch gear in a refinery plant. On complicated jobs like this, adjustable UNISTRUT cuts engineering and construction time to a minimum, and makes possible changes or additions at any time.



This installation in an industrial plant shows how trapeze frames of UNISTRUT channels are used to support conduit around a corner. The flexibility of this system and its rapid, on-the-job assembly make even the most difficult supporting jobs go fast.



This simple, three-step assembly shows why UNISTRUT framing saves you time and money on electrical framing. The special spring-held nut holds strong as a weld, yet no welding or drilling is ever required. Only a hacksaw and wrench are needed to build frames for almost everything.

Free Catalog!

Send today for your free copy of the 78-page catalog No. 700. Shows countless examples of how to rack, frame, suspend and support all kinds of mechanical and electrical equipment.

U. S. Patent Numbers

2327587 2541908 2529815 2545650
2563582 2696139 2580379 2405631
Other patents pending

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd.
Chicago 7, Illinois **Dept. W-11**

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☐ Catalog No. 700 ☐ UNISTRUT sample

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PAGE chain link FENCE

America's First Wire Fence—since 1883

• When next you need fence as protection against common hazards you certainly will want time-tested quality in the safeguard you provide. Whether you choose heavily galvanized Copper-Bearing Steel, corrosion-resisting Aluminum, or long-lasting Stainless Steel, PAGE Fence is quality controlled from raw metal to rugged fence erected on metal posts deep-set in concrete. Available are 8 basic styles, varied by heights, types of gates, top rails, and barbed wire strands for added security. Finally, your PAGE Fence will be expertly erected by a reliable, technically trained firm. For important fence data and name of nearest PAGE firm—

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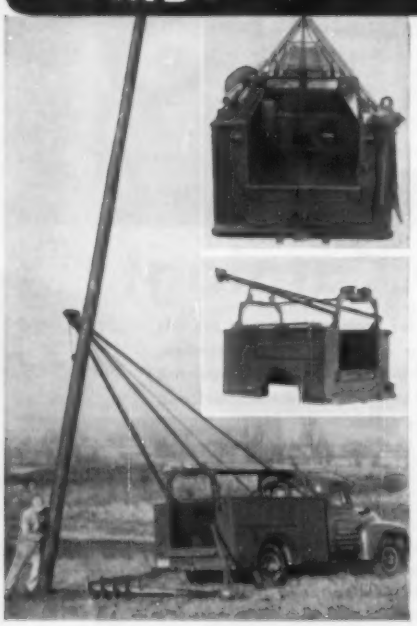
PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

Two-Man COMBINATION TRUCKS Pay Dividends



With a ¾ or 1-ton truck and Tel-E-Lect "Combination" Body, you can . . .

- **Dig holes and set poles up to 40'**
- **Handle your regular service work**
- **Reach a variety of jobs quicker**
- **Operate with two men at less cost**

IT'S A COMPLETE PACKAGE, tailored for your make and model of truck. Derrick, winch and digger drive are all assembled to the body, ready for your truck chassis. Easily mounted in a few hours by your local mechanic.

Write for Bulletin

TEL-E-LECT

PRODUCTS, Inc.

10003 Minnetonka Blvd., Minneapolis 16, Minn.

More New Products

(*Continued from page* 132)

W. S. Shamban & Co, 11617 W. Jefferson Blvd, Culver City, Calif., is making a thin **translucent film** to protect instruments against corrosive atmospheres. It has a tensile strength of 25,000 psi and high dielectric strength.

T. R. Finn & Co, Inc, Hawthorne, N. J., offers a line of high deflection, heavy duty **vibration hangers** designed to prevent transmission of noise and vibration from suspended equipment and to flexibly support piping systems.

Chemclean Products Corp, 610 Warren St, Brooklyn, N. Y., has a chemical **wire stripper** (No. 493) that removes Formvar, Formex, Isonel and baked enamel coatings from wire.

General Electric Co, Schenectady 5, N. Y. has:

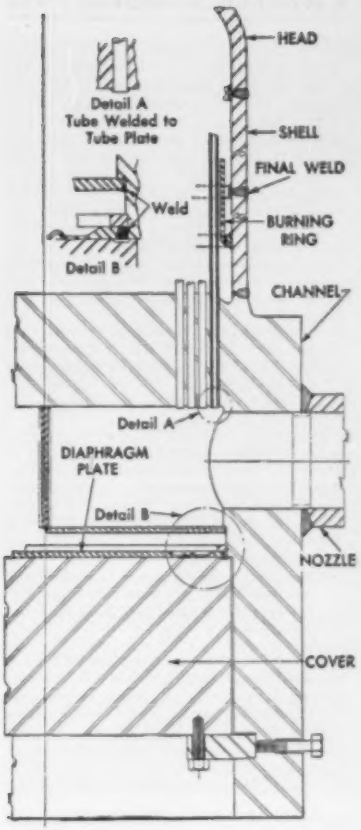
Encapsulated transformers for electronic equipment in industrial and commercial applications where protection is required against grease, oil and corrosive atmospheres.

Lamp ballasts for high output, rapid start fluorescents. They complete a line of 118-v, 60-cps, two-lamp ballasts for 800-ma operation. They are offered for indoor and outdoor low-temperature operation of 4, 6 and 8-ft lamps.

Reliance Electric & Engineering Co, 1088 Ivanhoe Rd, Cleveland 10, Ohio, offers an **adjustable-speed drive** for machine tool feeds. The drive affords a speed range of 100:1 with continuous speed adjustment over the entire range. Capacity is from ½ to 4 hp.

Minneapolis-Honeywell Regulator Co, Micro Switch Division, Freeport, Ill., offers a series of **plastic-encased switches** for use on domestic appliances. Available with button or plunger actuator, single or double throw, the switches are rated: 15 amp, 125 or 250 v; 1 hp, 250 v; ½ hp, 125 v.

Automatic Switch Co, 391 Lakeside Ave, Orange, N. J., offers a compact **differential relay** that will "drop-out" at 80 to 90% of pickup voltage with frequency held constant. With constant voltage, the relay will operate on variations of a fraction of a cycle. Power type relay contacts are used.



now... an all-welded, bottle-tight FEEDWATER HEATER, by FW

THE standard line of Foster Wheeler high-pressure feedwater heaters has now been supplemented with a new *all-welded* design. By eliminating all bolted and gasketed joints, the danger of leakage under thermal shocks is entirely avoided. This means quick start-ups with no need to control the rate of expansion.

Details of the welded shell-to-channel joint, tube joints and diaphragm construction of the new design are shown in the drawing above. All of these welds have been successfully field tested for several years and the design is now available for regular production.

If you have ever been troubled with heater gasket leaks and gasket maintenance, it will pay you to look into this bottle-tight, all welded heater. For detailed information, write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

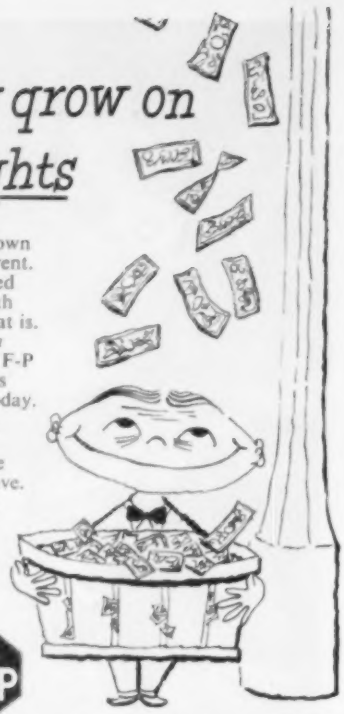
FOSTER WHEELER

making money grow on .....streetlights

Although no one as yet has grown money on trees, *streetlights* are different. At least when some economy-minded utility engineer has equipped them with Fisher-Pierce photoelectric controls, that is. On low *first* cost, on reduced *installation* cost, and minimum *maintenance* cost, F-P units are producing substantial savings for the hundreds of utilities using them today.

The F-P *Series 64400* control is a good example. Low initial cost and infrequent repair make it practical to use *one 64400 per lamp*, as many utilities have.

Add to this economy the *basic* advantages of F-P photoelectric lighting controls: light *when* it is needed, independent of time, season or weather; *dependable* operation, a result of Fisher-Pierce's ten years of experience in this field. Facts and figures for the asking.



THE FISHER-PIERCE COMPANY, INC.
82 Pearl Street, So. Braintree, Boston 85, Mass.

EXPORT:
Philips Export Corp., 100 E. 42nd Street, New York 17, N. Y.
In Canada:
Northern Electric Co., Ltd.

PRESSITE
an unsized fibreboard having excellent dielectric, physical and chemical properties. Is used principally in air, oil and askarel transformers.

ELECTRITE
a high grade board for electrical insulation, possessing high tensile and dielectric strength. Used in a large variety of punchings and other insulating applications.

DENSITE
an extremely hard and tough board of superior quality. Used by many leading manufacturers of electrical equipment to replace the more expensive types of insulating materials.

West Virginia Fibre Board
FOR ELECTRICAL INSULATION

PULP PRODUCTS DEPARTMENT

WEST VIRGINIA PULP and PAPER COMPANY
230 Park Avenue, New York 17, N. Y. 35 E. Wacker Drive, Chicago 1, Ill.

CATALOGS—BULLETINS

● **GE BULLETINS:** The following are available from General Electric Co, Apparatus Sales Div, Schenectady 5, N. Y.

The operation of a light-water and oil-moderated nuclear test reactor using enriched fuel is described in Bulletin GER-1123. Drawings and photos show design and construction features. Uses for the reactor are also given.

Bulletin GEA-6326A covers a swimming pool reactor, water boiler reactor, heavy-water research reactor and nuclear test reactor. Descriptions, illustrations and applications are given for each type.

● **WOOD POLES:** A booklet entitled: "A Report on Pole No. 92159," is a discussion on how and why creosote extends service life of wooden poles. United States Steel Corp, Rm. 2801, 525 William Penn Pl, Pittsburgh 30, Pa.

● **LIGHTNING ARRESTERS:** Bulletin 55104, 12 pages, is a comparative evaluation of the characteristics and features of valve and expulsion type distribution lightning arresters. Curves and wiring diagrams are used to show the merits and characteristics of each type. Much of the information is taken from the experience of utilities. Some is from the manufacturer's research engineers. Line Material Co, Milwaukee 1, Wis.

● **DISTRIBUTION TRANSFORMERS:** A 16-page illustrated bulletin (No. 61B6159E) describes design and construction features of distribution transformers rated from 3 to 167 kva, single phase, 15 kv and below. Recommended installation practices are included. Allis-Chalmers Mfg. Co, 932 S. 70th St, Milwaukee, Wis.

● **SUBSTATIONS:** "Specifications and Their Application in Substation Design" is a 5-page folder outlining material and construction specifications of present and future substation erection, revisions, and additions under various geographic and climatic conditions. Delta-Star Electric Div, H. K. Porter Company, Inc, 2437 Fulton St, Chicago 12, Ill.

● **EXHAUST FANS:** Bulletin No. 6414, 4 pages, covers fans for business and commercial exhaust applications. Ratings and performance characteristics, application information and dimensions are included. American Blower Corp, Detroit 32, Mich.

● **LUBRICATION:** A 16-page booklet describes chemical structure, specifications, properties, and applications of a group of fluorocarbon oils, waxes and greases for industrial use. M. W. Kellog Co, Box 469, Jersey City 3, N. J.

● **ATOMIC ENERGY:** "The Atom in Our Hands" is a 44-page booklet describing some of the work done at the atomic energy center at Oak Ridge, Tenn. It tells how radiosotopes are produced and how they are used in medicine, industry and agriculture. Photos of atomic reactors are included. Union Carbide & Carbon Corp, Rm 308, 30 E. 42nd St, New York 17, N. Y.

● **PLASTIC:** Advantages, applications, and procedures for using "Scotchply" reinforced plastic are given in a 20-page reference manual. Charts are included showing mechanical, electrical, chemical and thermal properties. Molding and handling instructions are also given. Minnesota Mining & Mfg Co, Dept. SP5-295, St. Paul, Minn.

"DESIGN OF PIPING SYSTEMS"

(Second Edition)

CONTENTS

- Strength and Failure of Materials
- Design Assumptions, Stress Evaluation, and Design Limits
- Local Components
- Simplified Methods of Flexibility Analysis
- Flexibility Analysis by the General Analytical Method
- Flexibility Analysis by Model Test
- Approaches for Reducing Expansion Effects: Expansion Joints
- Supporting, Restraining, and Bracing the Piping System
- Vibration Prevention and Control
- History and Derivation of Piping Flexibility Analysis
- Derivation of Acoustic Vibration Formulas
- Charts and Tables

AS POWER PIPING BECOMES MORE CRITICAL

M. W. KELLOGG'S DESIGN EXPERIENCE KEEPS PACE

As temperatures and pressures increase in steam-electric power plants, the problems involved in designing, engineering, and fabricating main and reheat steam piping multiply themselves many times over. This emphasizes, more than ever, the value of the long experience, in the laboratory and on the job, of The M. W. Kellogg Company—leader in the power piping field.

More evidence of M. W. Kellogg's accumulated piping design experience and ability to tackle each new power piping project in its stride, is the company's new 400-page book, "Design of Piping Systems"—to be published shortly by John Wiley & Sons. The most comprehensive work ever made available publicly on the physical design of piping, it is one of the many ways M. W. Kellogg cooperates with consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment. An outline of contents is shown above.

You can be sure of getting your copy of this limited edition of "Design of Piping Systems" by writing now to M. W. Kellogg, asking to be notified as soon as the book is available. Ask also for the new, free, 12-page booklet, "Piping Flexibility Analysis," which shows how M. W. Kellogg's various flexibility analyses techniques can cut piping design and construction costs.

FABRICATED PRODUCTS DIVISION

THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N. Y.

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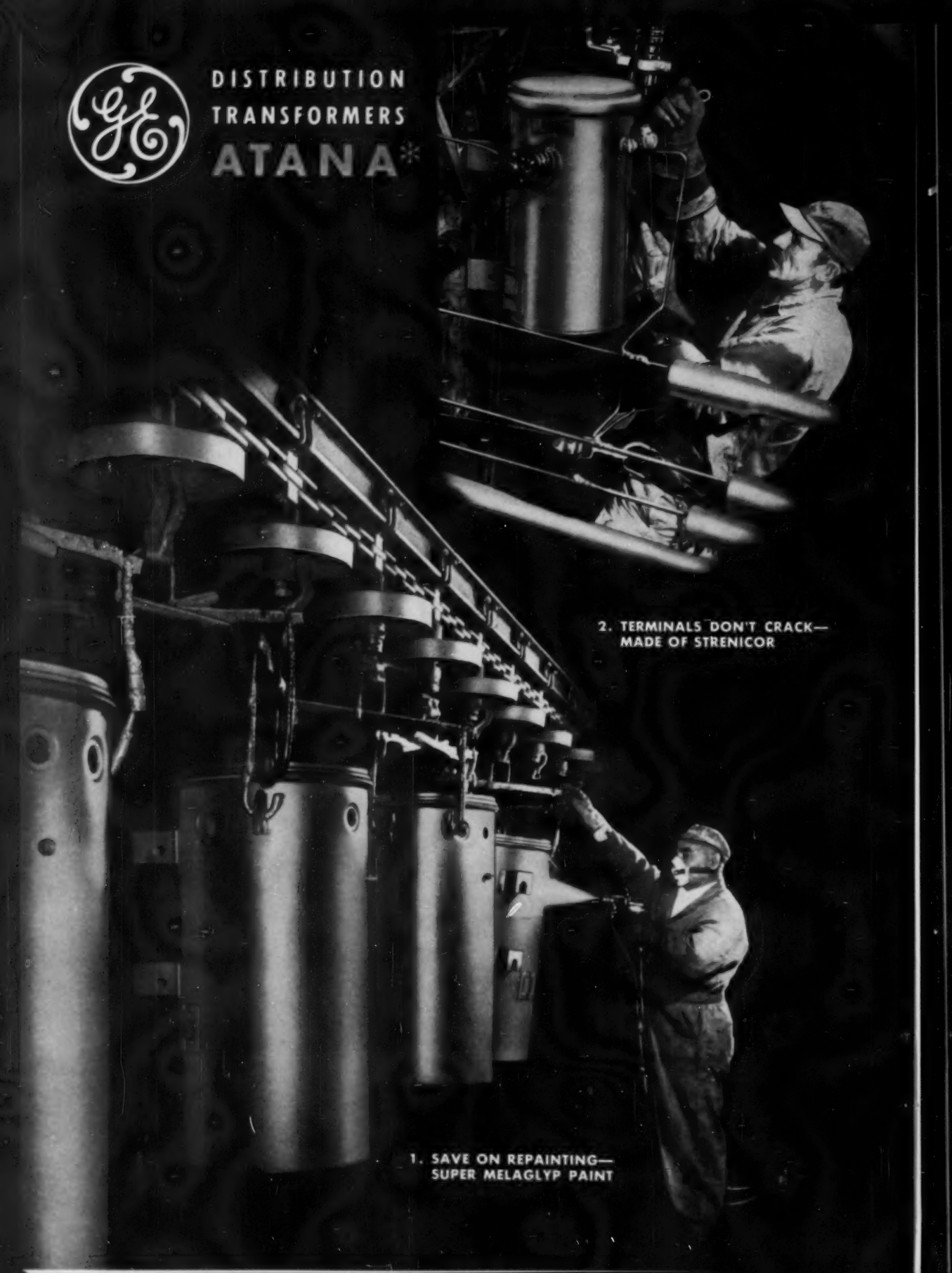
SUBSIDIARIES OF PULLMAN INCORPORATED

POWER PIPING—THE VITAL LINK

DISTRIBUTION
TRANSFORMERS
ATANA*



2. TERMINALS DON'T CRACK—
MADE OF STRENICOR

1. SAVE ON REPAINTING—
SUPER MELAGLYP PAINT

3. GASKETS ARE REUSABLE—
MADE OF NITRILE

4. EASY TO OPEN—
ONE-PIECE COVER BAND

Picture-list of ways to spend

LESS MONEY FOR MAINTENANCE

Figure it out for yourself. With the large number of distribution transformers on your lines, a little money saved on each adds up. Here are four ways that General Electric transformers help you spend less money on maintenance:

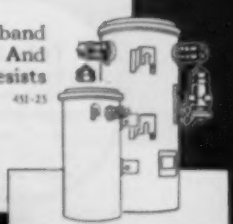
Save up to 2 repaintings. By actual tests, G.E.'s new Super Melaglyp averages 50% longer life than the best finish previously used. Longer paint life means you save one, perhaps two, repaintings.

Terminals that won't crack. Since the terminal clamps are made of Strenicor, a special alloy that resists season cracking, they're practically immune to failure.

No need for new gaskets. All tank openings on G-E transformers are sealed with *reusable* nitrile rubber gaskets. They don't have to be scraped off and can be used again and again.

Easy to open. The one-piece cover band comes off with only a screwdriver. And it's made of stainless steel which resists corrosion and maintains a tight seal. 451-23

*ATANA. Since only G.E. gives you all these money-in-the-bank features, it should be obvious that *All Transformers Are Not Alike.* General Electric Company, Schenectady 5, New York.



CONVENTIONAL—SELF PROTECTED
take your choice
General Electric makes both

Progress Is Our Most Important Product

GENERAL ELECTRIC

NOW– Molded Current Transformer Line Extended to 4000 Amps

Money-saving advantages now available on higher rated units

TYPE BKM for 1200 and 1500-ampere use has opening for primary conductor 4¼" high, 1¾" wide.

TYPE BKM for 2000 and 4000-ampere application has 4¼" square opening for primary conductor.

New Additions to Allis-Chalmers service-proved line of molded current transformers are designed for heavy duty metering. Liberal design provides plenty of overcurrent capacity, with no overheating or reduction of accuracy.

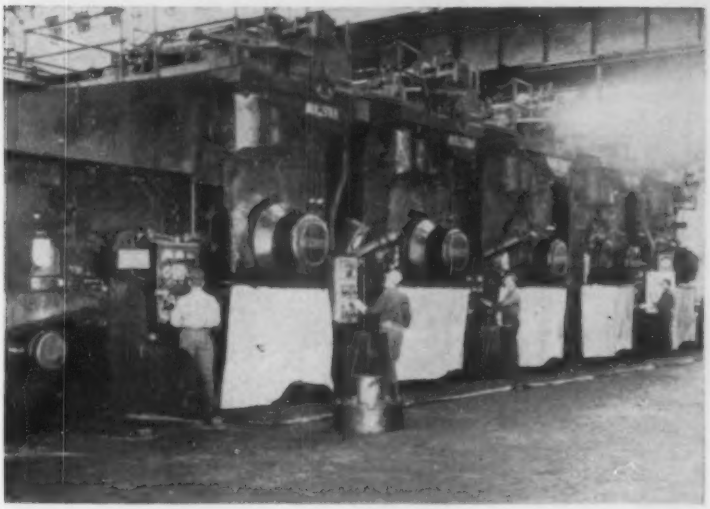
- **No Painting Required** because these transformers are cast in thermo-setting resin, which provides high impact strength and excellent weather and fire resistance. Stocking problems are simplified because these units can be used either indoors or outside.
- **Mounting is Simplified.** These transformers can be mounted in any position. If desired, the base can be removed to mount on any convenient flat surface — walls, bars, channels, etc. A removable short-circuiting device and sealable secondary terminal cover are standard. A conduit box can be substituted for the secondary terminal cover.
- **Easy Conversion** to 5000-volt bar-type units will be made with a handy conversion kit, as on previously announced smaller units in the line.

GET INFORMATION on these new transformers by calling your nearby Allis-Chalmers office. Or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

ALLIS-CHALMERS

A-4886

MANUFACTURERS AND MARKETS



GE's Automatic Gage Controls Steel Mill

An automatic gage system controls the thickness of strip steel on this five-stand tandem cold reduction mill at United States Steel Corp's Irvin Works near Pittsburgh. The system is virtually self-inspecting. It automatically compensates for product and operational variations, providing closer tolerance than previously obtainable.

Developed jointly by General Electric Co and U. S. Steel, the system uses transistor and magnetic-amplifier components rather than vacuum tubes. GE says this is the first system of its kind with a full complement of auxiliary inspection and reset functions integrated with the overall drive system to reduce manual operations to the minimum.

Built by GE's industry control and x-ray departments, the system controls speed and rolling pressure of the mill as the strip passes through the roll stands at 3,800 ft per min. The strip is coiled under tension when delivered from the last stand.

Desired steel thickness is maintained by x-ray gages and electrical controls. Variations in thickness are held to a minimum by a screwdown control that varies reduction on the first stand and by a vernier system that controls the roll speed of the last stand.

Koenig Views Copper Price, Expansion

Continued fluctuation in the copper price was forecast recently by Robert P. Koenig, president of Cerro de Pasco Corp, New York.

All metals are "fringey," Koenig observed. Price and availability make metals "move in and out . . . in a simple interplay of supply and demand," he noted.

Possible competition from aluminum with present high-priced copper is a matter of concern, Koenig declared, but "it doesn't keep me awake at night."

Cerro's negotiations with Circle Wire & Cable Corp will be concluded happily soon, Koenig predicted. Cerro, largest industrial enterprise in Peru, recently offered $20.25 million for Circle W&C, a Maspeth, L.I., producer of copper wire, conduit and cable. This move will further diversify Cerro, essentially a non-ferrous mining company since the turn of the century.

Just returned from a six-week trip through England, Belgium and France, Koenig predicted a continuation of Western Europe's boom in durable consumer goods and possible extension to underdeveloped areas.

Ryerson Buffalo Addition to Be Ready in Early 1956

An addition of almost 50,000 sq ft is about 75% finished at the Buffalo, N. Y., steel service plant of Joseph T. Ryerson & Son, Inc., advised Paul L. Wright, plant manager. It is expected to be completed in early 1956.

This new building has stainless steel sandwich wall construction, reported pioneered by Ryerson in the mill-type or craneway building field. This type of construction is said to provide better insulating value than an 8-in. standard brick wall and at a lower cost.

Improvement in the office includes a continuous conveyor belt system for handling orders through the sales, credit and stock control departments. Paper work in the order handling can be done without anyone having to leave his desk. Thus elapsed time between receipt of order and dispatching of the order to the warehouse can be cut to a minimum, it is reported.

Federal Pacific Electric Expands in Atlanta, Dallas

A 10,000-sq ft regional warehouse will be opened Dec. 1 at Atlanta, Ga., by Federal Pacific Electric Co of Newark, N. J. Daniel P. Lacock, regional sales manager at Atlanta, stated that the company's plans also call for erection of a 30,000-50,000-sq ft assembly plant there.

Federal Pacific's present facilities at Dallas, Tex., will be replaced by a 46,000-sq ft manufacturing plant now under construction. The Dallas factory makes power and distribution equipment to job specifications.

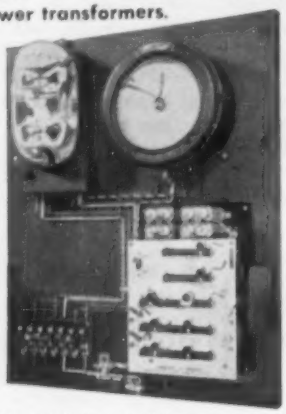
U. S. Aluminum Production

Primary aluminum production in U.S., according to the Aluminum Association, New York, was 130,605 tons in September, down from 133,551 tons in August but up 10,000 tons from 120,332 tons in September 1954. Production for the first nine months this year was about 1,156,690 tons, an increase of almost 69,501 tons over the same 1954 period.

(*More M & M on page* 142)

Transformer Loss Compensator *Saves you Money!*

BECAUSE it provides an accurate means of measuring the energy and demands of high-voltage services at the low-voltage side of the power transformers.



This installation at 2.3 kv saved about $2600 compared with 34.5 kv metering; it saves about $5500 over metering at 69 kv.

THE TESCO compensator adds to the registration of the watthour meter an amount equal to the sum of the iron and copper losses of the transformer bank. It may be used with practically any type of watthour meter and . . . importantly . . . no changes are made in the meter itself, either structurally or in adjustments . . . It is produced in two and three element types for use with two-element or three-element meters on any type circuit.

Some of the Users . . .

Phila. Electric Co. Penna. Power & Light Co. Texas Power & Light Co. U. S. Bureau of Recl. Public Service Co. of New Hampshire. Utah Power & Light Co. Northern States Power Co.

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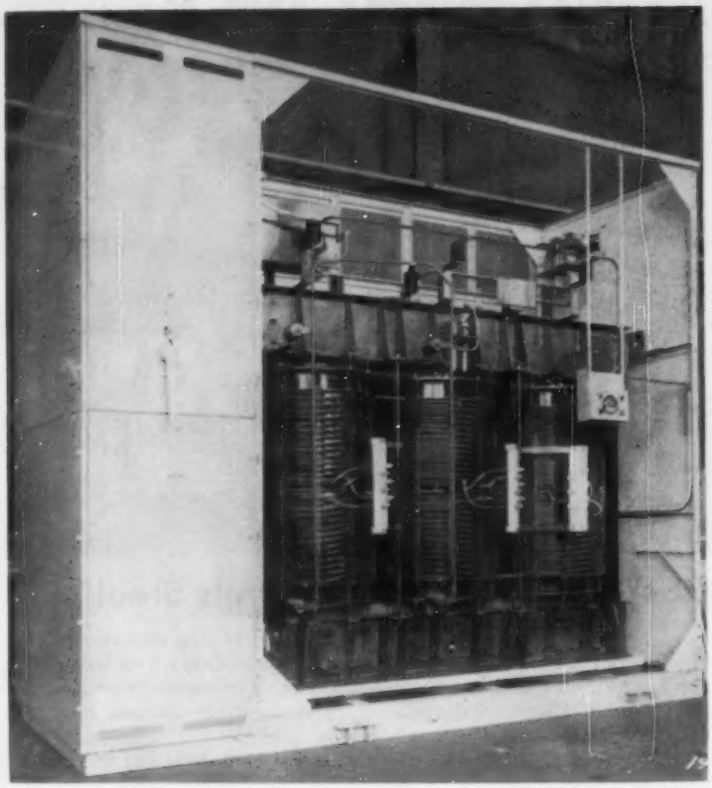
FREE
Detailed information on operation, installation, applications. Write for Bulletin NO. 63-A.

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.



Large Dry-Type Transformer Shipped

A 4,000-kva dry-type transformer, believed to be the largest three-phase single-core unit ever constructed, was shipped recently by Maloney Electric Co to a southwestern utility.

This transformer has a 13.2-kv delta primary with two 2.5% full capacity taps above and below normal and 2.4-kv delta secondary. Provision has been made for the future addition of forced-air-cooling equipment to increase capacity to 5,333 kva. Fan control will be from winding temperature relays.

Removable panels allow easy access to the primary terminal boards for tap adjustments. In addition, a control panel housing the winding temperature relay alarm circuit and latch relays for alarm and trip circuits is mounted on the front of the enclosure to permit ease of inspection.

Total weight of assembled transformer and cubicle is 33,500 lb. Overall height of the unit is 138 in., and floor space occupied is 68 x 122 in.

Automatic Batch System Treats GE Transformers

Transformers are now impregnated in a completely automatic batch system at General Electric Co's specialty transformer plant at Ft. Wayne, Ind.

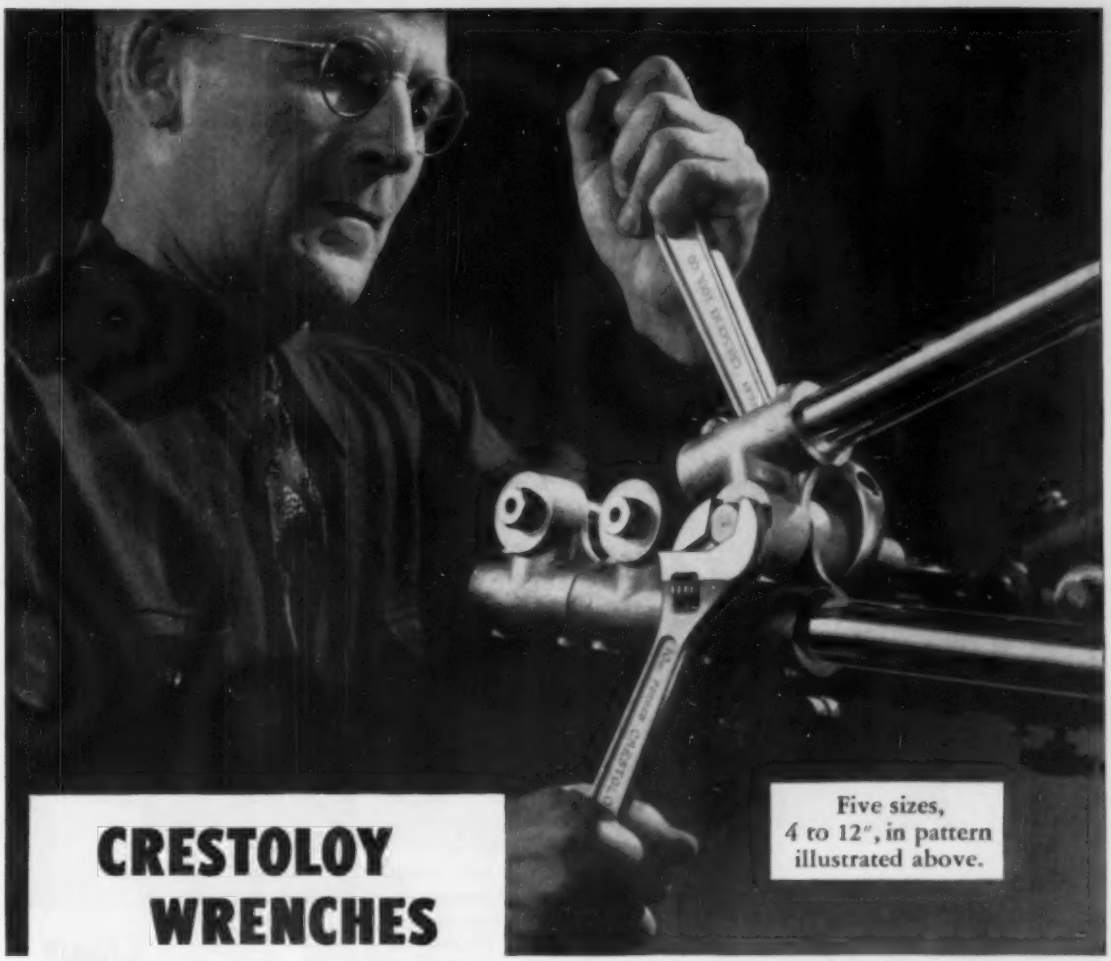
The system was designed by GE to improve product quality and to supplement output of another Ft. Wayne transformer plant. Blaw-Knox Co of Pittsburgh built and installed the system.

Key of the system is a remotely controlled car with a traversing carriage that loads, discharges and transfers racks of transformers through several operations.

Transformers are loaded on pallets by electric hoists. The car then takes over and automatically picks up the pallet, transferring it to a preheat oven, then to the impregnator and finally back to the loading stands.

The car is 12 ft wide, 10-2/3 ft long and weighs 10 tons. It can carry 6 tons at ½ ft per sec.

(*More M & M on page* 144)



Five sizes,
4 to 12", in pattern
illustrated above.

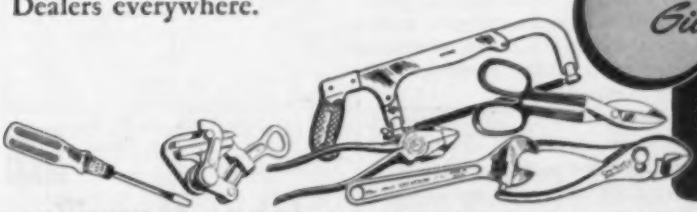
CRESTOLOY WRENCHES

Forged from Crescent's own CRESTOLOY Steel, these fine wrenches are 200% stronger and 30% thinner than conventional adjustable wrenches. They are hardened by a selective induction process which guarantees longer life through a combination of surface hardness and interior toughness. Chrome plate finish. Sold by Industrial Distributors and Hardware Dealers everywhere.

DOUBLE END
Four sizes in 4-6", 6-8", 8-10", and 10-12" size combinations.

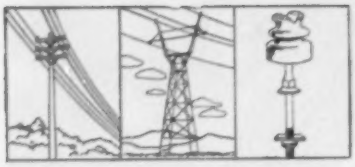
TAPERED HANDLE
Three heavy-duty sizes, 15", 18" and 24", have tapered handle as illustrated.

CRESCENT TOOLS
Give Wings to Work
®
Sign of the Artisan
Symbol of Excellence

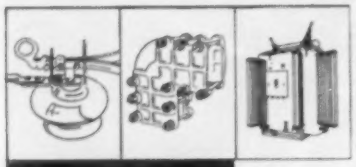


Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK



Keep Nuts Tight
on all bolted assemblies



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PALNUT
LOCK NUTS

PALNUT Lock Nuts apply so fast, lock so dependably . . . you can specify them for every nut-and-bolt assembly, at negligible cost. Maintenance is reduced on mechanical assemblies—full conductivity assured on electrical connections.

PALNUT Lock Nuts may be used on new or existing equipment. Easily removed and re-used when servicing. Require only 3 bolt threads. Available in Parkerized and hot dip galvanized steel; also silicon bronze.

Send for free samples and Bulletin #577

THE PALNUT COMPANY
51 Cordier St.,
Irvington 11, N. J.

PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

New Welder Joins Tanks of Wagner Transformers

A self-propelled gantry type welding head manipulator has been installed by Wagner Electric Co to fabricate transformer tanks at its plant in Mount Vernon, Ill. The gantry travels to job locations and welds seams, top rings, brace bars and bases.

The unit, built by Pandjiris Weldment Co of St. Louis, Mo., stands 30-ft high and is 38-ft wide at the base. An operator travels with the welding head and has visual control of welding at all times. The head can be positioned vertically and horizontally and can weld 20 ft uninterruptedly in any segment of a 20-ft diam circle without movement of the gantry.

Kaiser Engineers to Build Test Reactor for AEC

A construction contract for a $15 million engineering test reactor has been awarded Kaiser Engineers by the Atomic Energy Commission. The reactor will be built at the National Reactor Testing Station at Arco, Idaho. Primary job of the reactor will be to test fuel elements and other power system components.

The reactor will be light water moderated and cooled. Uranium enriched in U-235 will be used as fuel. The unit will operate at 175,000 kw of heat. General Electric Co will build the reactor core and "inside" facilities.

New DuPont Laboratory Aids Sales Development

A sales development and technical service laboratory was opened recently at Chestnut Run, near Wilmington, Del., by the film department of E. I. duPont de Nemours & Co, Inc.

The $1-million laboratory explores new markets for Mylar polyester film, acetate film and various cellulose products. It is concerned also with improvement of quality, properties and utility of these products.

Operations include physical testing of products, design and development of packages and packaging machinery, investigation of printing and laminating problems, and exploration of electrical and industrial uses of films.

Volseal...

the new high dielectric putty...

makes sealing easier!

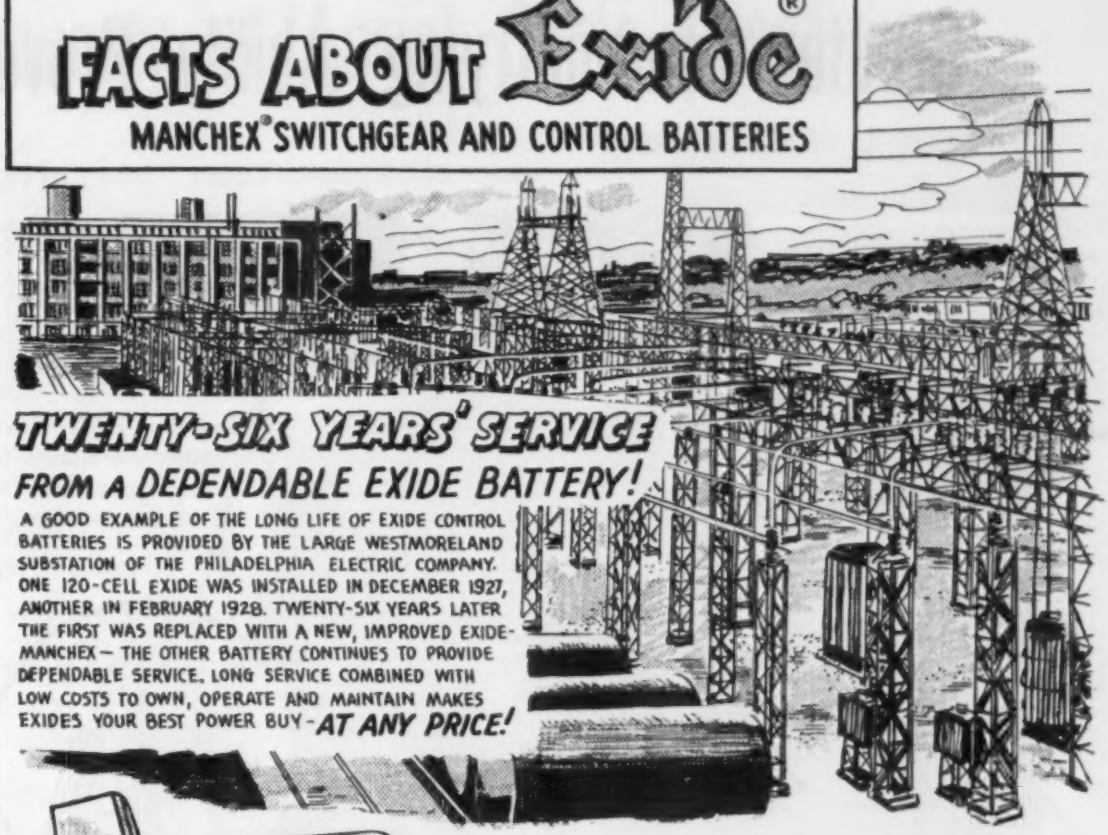
New Johns-Manville Volseal is a high dielectric putty designed for sealing heavy cables and irregularly shaped objects. It has a dielectric of 445 vpm, together with excellent physical properties. Resists acids and alkalis, weathers well, is highly resistant to water, does not corrode metals.

Volseal also offers easy application. It is highly elastic, provides good adhesion, hardens within 3 hours on air curing. Available in extruded beads, ribbons and pugs. For complete details on Volseal and its new companion product Napseal, the petroleum resistant sealing compound, write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

Johns-Manville
SEALING COMPOUNDS

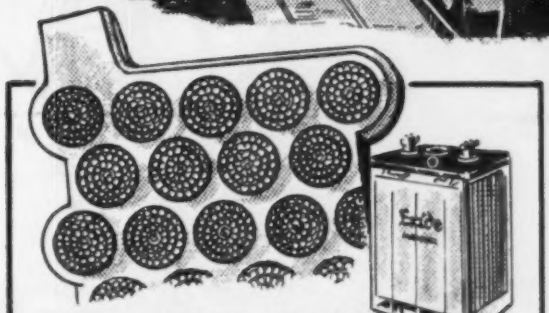
FACTS ABOUT Exide®

MANCHEX® SWITCHGEAR AND CONTROL BATTERIES



TWENTY-SIX YEARS' SERVICE FROM A DEPENDABLE EXIDE BATTERY!

A GOOD EXAMPLE OF THE LONG LIFE OF EXIDE CONTROL BATTERIES IS PROVIDED BY THE LARGE WESTMORELAND SUBSTATION OF THE PHILADELPHIA ELECTRIC COMPANY. ONE 120-CELL EXIDE WAS INSTALLED IN DECEMBER 1927, ANOTHER IN FEBRUARY 1928. TWENTY-SIX YEARS LATER THE FIRST WAS REPLACED WITH A NEW, IMPROVED EXIDE-MANCHEX — THE OTHER BATTERY CONTINUES TO PROVIDE DEPENDABLE SERVICE. LONG SERVICE COMBINED WITH LOW COSTS TO OWN, OPERATE AND MAINTAIN MAKES EXIDES YOUR BEST POWER BUY - *AT ANY PRICE!*

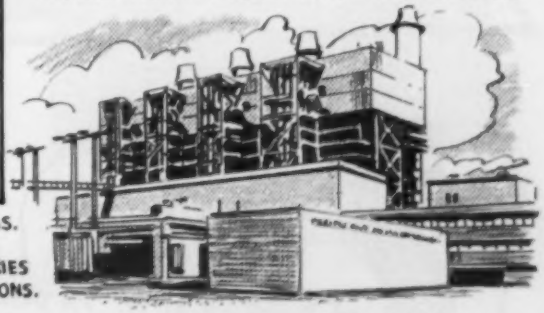


INSIDE AN EXIDE-MANCHEX THE SECRET OF LONG LIFE... DEPENDABLE POWER!

THE EXCLUSIVE MANCHESTER POSITIVE PLATES ARE THE HEART OF THE MANCHEX BATTERY... THE SOURCE OF POWER. LEAD BUTTONS ARE PRESSED INTO HOLES OF THE GRID. ONLY A SMALL PORTION OF THE TOTAL LEAD IS FORMED INITIALLY INTO ACTIVE MATERIAL. THE REMAINDER IS AVAILABLE FOR GRADUAL CONVERSION DURING YEARS OF SERVICE. YOU GET LONGER LIFE... MORE DEPENDABLE POWER IN LESS SPACE!

POSITIVE OPERATION OF SWITCHGEAR ASSURED BY EXIDE-MANCHEX BATTERIES IN THE WEST'S LARGEST STEAM PLANT

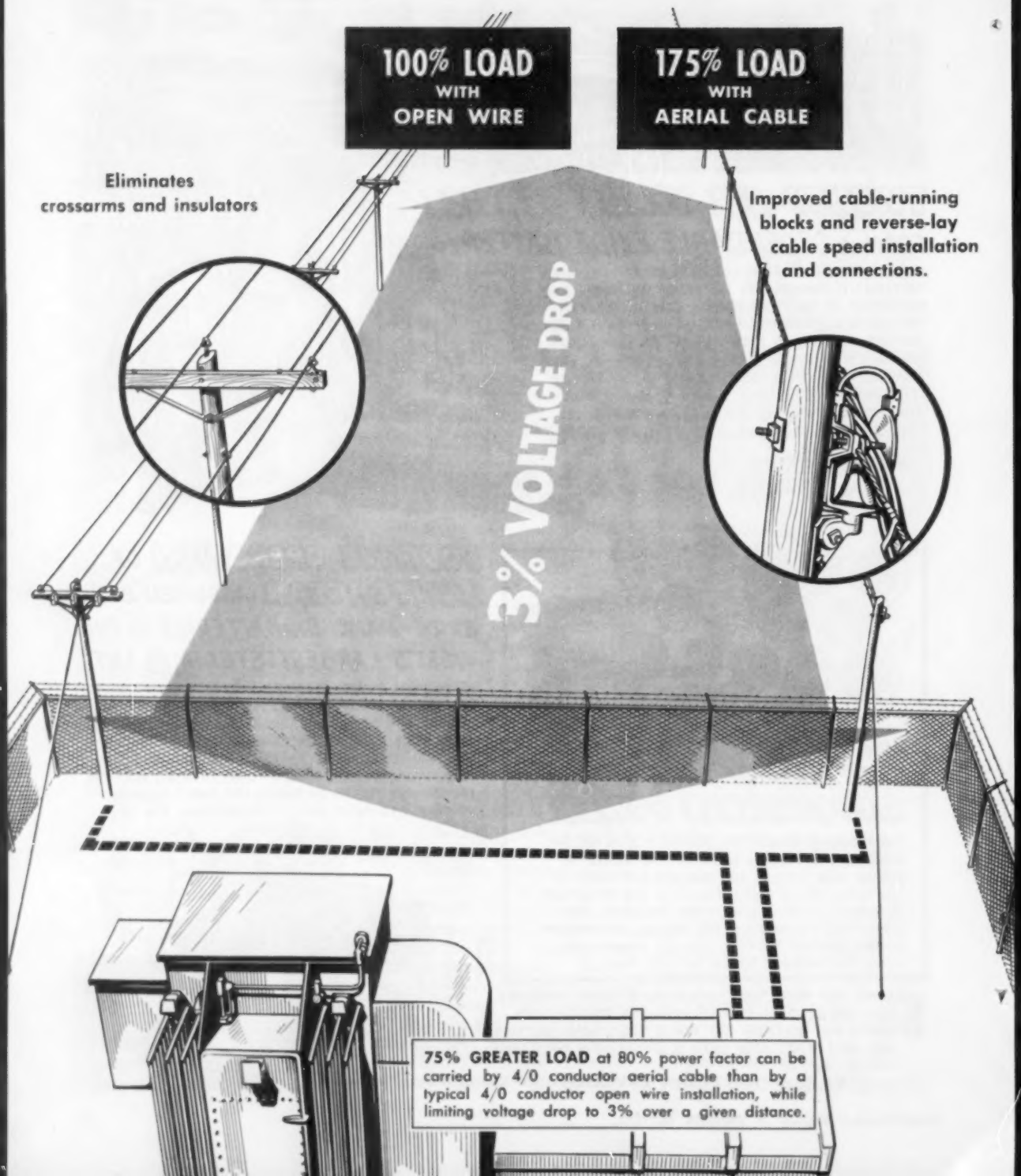
DEPENDABLE POWER FOR INSTANT OPERATION OF CIRCUIT BREAKERS... ADEQUATE RESERVE POWER FOR ALL OTHER CONTROL CIRCUITS AND EMERGENCY LIGHTING! THAT IS WHAT EXIDE-MANCHEX BATTERIES FURNISH AT PACIFIC GAS AND ELECTRIC'S ULTRA-MODERN, MAMMOTH PITTSBURG, CALIF., STEAM ELECTRIC PLANT. UTILITIES ALL OVER THE COUNTRY DEPEND ON EXIDES FOR AMPLE STANDBY VOLTAGE... TO AVOID COSTLY OPERATIONAL FAILURES.



LET EXIDE HELP SOLVE YOUR SWITCHGEAR BATTERY PROBLEMS.
1. CALL AN EXIDE SALES ENGINEER FOR FULL DETAILS.
2. WRITE FOR BULLETIN 210 - WHICH TELLS HOW BATTERIES ARE MOST EFFICIENTLY USED IN SWITCHGEAR OPERATIONS.

Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.

Greater Load-carrying Ability Proves


100% LOAD
WITH
OPEN WIRE
175% LOAD
WITH
AERIAL CABLE
Eliminates
crossarms and insulators
Improved cable-running
blocks and reverse-lay
cable speed installation
and connections.
3% VOLTAGE DROP
75% GREATER LOAD at 80% power factor can be carried by 4/0 conductor aerial cable than by a typical 4/0 conductor open wire installation, while limiting voltage drop to 3% over a given distance.

Economy of Aerial Cable Feeders

Continuing improvements in installation techniques indicate further reductions in cost

Because of its lower reactance, General Electric Super Coronol* preassembled aerial cable can carry far more load within a permissible voltage drop than open wire of the same size. Thus, if you evaluate cost on the more realistic basis of dollars per kva of load instead of cost per mile of line, the initial cost of aerial cable is actually only 3 to 12% more than open wire. (See comparative graphs.)

You also receive these extra benefits:

BETTER APPEARANCE

Crossarms, insulators, and unsightly open wire lines are eliminated.

LOWER MAINTENANCE COSTS

Fewer storm damage repairs, less tree trimming, no insulation festooning.

FEWER OUTAGE REVENUE LOSSES

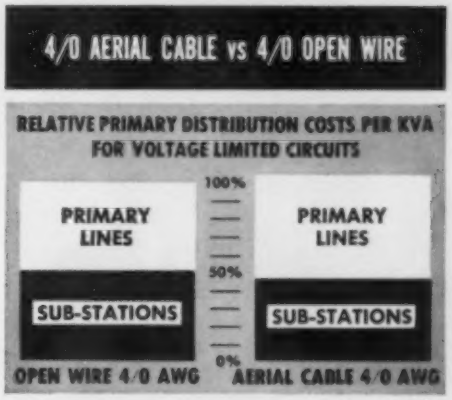
Greater reliability—because messenger-supported cables are far less vulnerable to damage by elements and falling trees—reduces feeder outages and resulting loss of revenue. Better service continuity improves customer relations.

INCREASED LOADS

Greater loads can be carried on voltage-limited 4160-volt feeders, up to a load density of 7500 kva per square mile, because of the combination of the low reactance and 85 C copper temperature of G-E Super Coronol preassembled aerial cable.

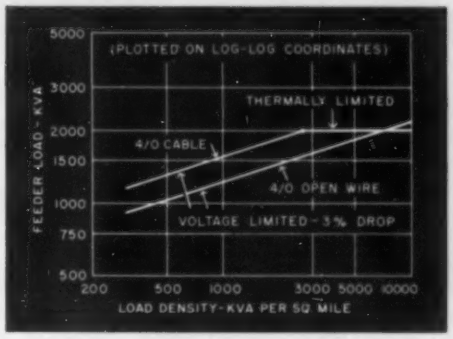
For additional facts send for "Economic Performance of Aerial Cable for Distribution Systems." Address Section W-154-1127, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

*Registered Trade-mark General Electric Company



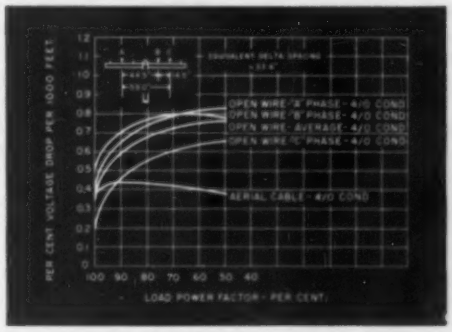
COST

Comparative primary distribution costs per kva for voltage limited circuits



FEEDER LOADING

Load density characteristics of 4160-volt feeders with 3% voltage drop limitation

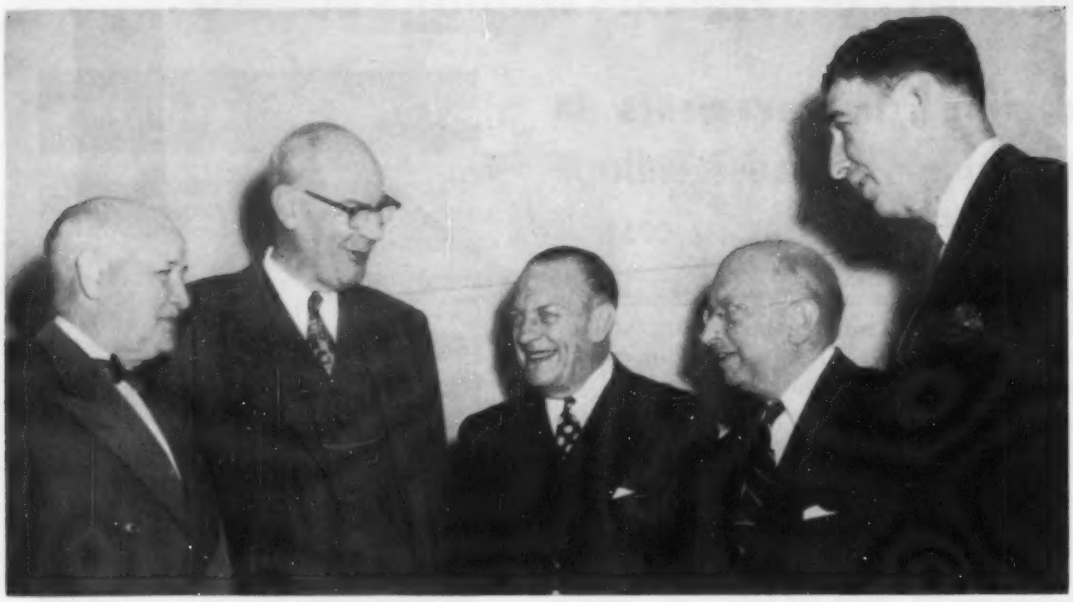

OPEN WIRE "A" PHASE - 4/0 COND
OPEN WIRE "B" PHASE - 4/0 COND
OPEN WIRE - AVERAGE - 4/0 COND
OPEN WIRE "C" PHASE - 4/0 COND
AERIAL CABLE - 4/0 COND
PER CENT VOLTAGE DROP PER 1000 FEET
LOAD POWER FACTOR - PER CENT

VOLTAGE DROP

Voltage regulation per 1000 feet 4.16 kv feeders, 1000 kva base, 3 phase

Progress Is Our Most Important Product

GENERAL ELECTRIC



J. W. COREY J. L. SINGLETON A. F. METZ A. A. BERARD J. F. MILLER

NEMA Convention Elects New Slate

National Electrical Manufacturers Association elected James W. Corey as its new president at the recent annual meeting in Atlantic City, N. J. Other new officers include J. L. Singleton, vice president of Industries Group, Allis-Chalmers Manufacturing Co, who was elected a vice president; and Joseph Miller, NEMA, who was made new managing director. N. J. MacDonald, president of Thomas & Betts Co, is newly-elected to the Officers Committee at large.

Re-elect 4 Vice Presidents

Re-elected as vice presidents for the coming year were F. F. Loock, president of Allen-Bradley Co, Milwaukee; J. J. Mullen, Jr, president of Moloney Electric Co; B. C. Neece, president of Landers, Frary & Clark; and W. V. O'Brien, vice president and general manager of General Electric Co's Apparatus Sales Division.

NEMA treasurer A. A. Berard, president of Ward Leonard Electric Co was re-elected to that post, and Hoyt P. Steele, president of Benjamin Electric Manufacturing Co, was re-elected as a member of the Officers Committee at large.

Renamed as appointed members of the officers committee were W. R. Persons, president of Emerson Electric Manufacturing Co; George T. Pfleger, president of United States Electrical Motors; and Joseph S. Thompson, president of Federal Pacific Electric Co.

New Governors Named

Newly elected to fill vacancies existing on the board of governors were T. Pierre Champion, president of Champion Rivet Co; J. F. Lincoln, chairman of the board of Lincoln Electric Co; and A. E. Pringle, II, vice president of Pringle Electric Manufacturing Co.

Of the 13 governors whose terms end in 1955, one was newly elected and 12 were re-elected for three-year terms. A. D. R. Fraser, president of Rome Cable Corp is the newly elected governor.

Re-elected were Berard; W. H. Burleson, manager of power utilities department, Ohio Brass Co; R. M. Casper, administrative assistant, vice president, Industries Group, Allis-Chalmers; William S. Edsall, president of Chase-Shawmut Co; S. M. Ford, president of Silex Co; Harvey Hubbell, president of Harvey Hubbell, Inc; J. H. Jewell, vice president of Westinghouse Electric Corp; J. R. MacDonald, president of General Cable Corp; Neece; O'Brien; F. H. Roby, vice president of Square D Co; and Steele.

Corey, president of Reliance Electric & Engineering Co since 1944 and director and president of the company's Canadian subsidiary in Ontario, succeeds A. F. Metz, board chairman of Okonite Co, as NEMA president.

Singleton, A-C vice president since 1951, formerly served as General Machinery Division's sales director and vice president.

Since joining NEMA in 1953 as recording secretary of its wire and cable section, Miller has also served as assistant managing director. Before his association with NEMA, he was director of the Copper Division, Metals and Minerals Bureau of the National Production Authority.

During his 34 years with Thomas & Betts, MacDonald has also served as sales manager, director of the company, vice president in charge of sales, and general vice president.

(*More News About People p.* 150)

He's coming to help you

He is a Bell System communications engineer. His purpose is to help you speed your operations, cut your costs and improve your service—by making sure your communications meet your exact requirements.

The Bell System offers a wide variety of private line services, including telephone, teletypewriter and mobile radio systems. And the Bell System tailors these facilities to meet specific individual needs, so that you maintain high-speed contact between your various departments, branches, factories, warehouses, as well as between you and your suppliers, customers, distributors and shippers.

Why not let a Bell System communications engineer make a study of your communications requirements and recommend the kind of service, or a combination of services, which will best meet your specific needs?

• • •

His survey is free and his recommendations are yours without obligation. You can reach him by calling your nearest Bell Telephone business office.

BELL TELEPHONE SYSTEM

TELEPHONE TELETYPEWRITER MOBILE RADIO TELEMETERING AND REMOTE CONTROL CHANNELS

Blessing Is Named Dow Vice President

Olin D. Blessing, sales manager of Dow Corning Corp, has been elected a vice president of the company.

When Dow Corning was formed in 1943, Blessing was made general sales manager. He was formerly associated wtih Dow Chemical Co where he served in the Cellulose Products Division and later in the sales department.

O. D. BLESSING

PERSONAL BRIEFS

Chris J. Witting, formerly president of Westinghouse Broadcasting Co, has been appointed general manager of consumer products for Westinghouse Electric Corp, succeeding **John M. McKibbin** who joins the staff of **John K. Hodnette,** vice president and general manager. **Donald H. McGannon,** vice president and general executive of the broadcasting company, succeeds Witting.

New purchasing agent for Colorado Central Power Co is **Homer N. Todd,** who has been in charge of district accounting for the past three years. In addition to all company purchasing, Todd will supervise all company warehouses, stores records, and accounting and inventories.

Alan W. Hastings has joined Gulf States Utilities Co as assistant to President **Roy S. Nelson.** He succeeds **J. J. Morrison** who was recently appointed executive vice president of engineering and production.

General Electric Co has named **William W. Bryan** manager of Construction Materials Division's Pacific district, replacing **Daniel F. Flinn, II,** who has resigned. Previous to his present appointment, Bryan was manager of the division's northwestern district, a post he will continue to fill temporarily.

Arthur M. Kiely has been elected treasurer of Buffalo Forge Co, in addition to his duties as vice president and director. The post of treasurer was previously held by **Edgar F. Wendt,** president.

Allis-Chalmers Manufacturing Co has announced the appointment of **William G. Lewis** as manager of sales, circuit breakers, and **Frank T. Gifford** as chief engineer, circuit breakers, at the company's Boston works. . . . A-C also named **William J. McGowan** to the newly created post of director of Industrial and Community Relations Division.

General Cable Corp has announced the election of **James R. MacDonald** as chairman of the board, succeeding the late **Irving J. Bennett.** He will also continue as president, a post he has held since 1951.

Fairbanks, Morse & Co has elected **Robert D. Brown** as assistant secretary and assistant treasurer . . . New manager of Johns-Manville Corp's market surveys department is **Edward C. Koch.** He succeeds the late **E. A. Phoenix.**

Gerhard L. Oscarson, chief application engineer of Electric Machinery Manufacturing Co, has been elected a fellow in the American Institute of Electrical Engineers for "engineering development and coordination of design of rotating electric machinery to the changing requirements of industry and national defense."

Paul C. Ford has been named chief engineer of Wagner Electric Corp's Electrical Division to succeed **C. P. Potter** who is retiring after more than 46 years with the company. Ford was previously assistant manager of Wagner's Transformer Engineering Division.

William F. Jameson has been appointed manager of engineering of Maryland Shipbuilding & Drydock Co's newly established Industrial Products Division. **Philip Myers, Jr,** has been named manager of sales for the division.

J. P. Caulfield, general manager of Western Mining Division, has been appointed assistant to Kennecott Copper Corp's vice president, **Frank R. Milliken.** His successor is **C. D. Michaelson,** vice president and chief executive in Chile of Braden Copper Co, a Kennecott subsidiary.

New comptroller of Electric Storage Battery Co is **M. G. Smith,** former executive vice president of Rockwood & Co.

Obituary

Walter C. Parker, 71, secretary-treasurer of Duke Power Co, died in New Rochelle, N. Y. He was associated with Southern Power Co, now the Duke Power Co, since 1905 and served as secretary-treasurer since 1913.

Harllee Branch Attacks 'Favored' Power Groups

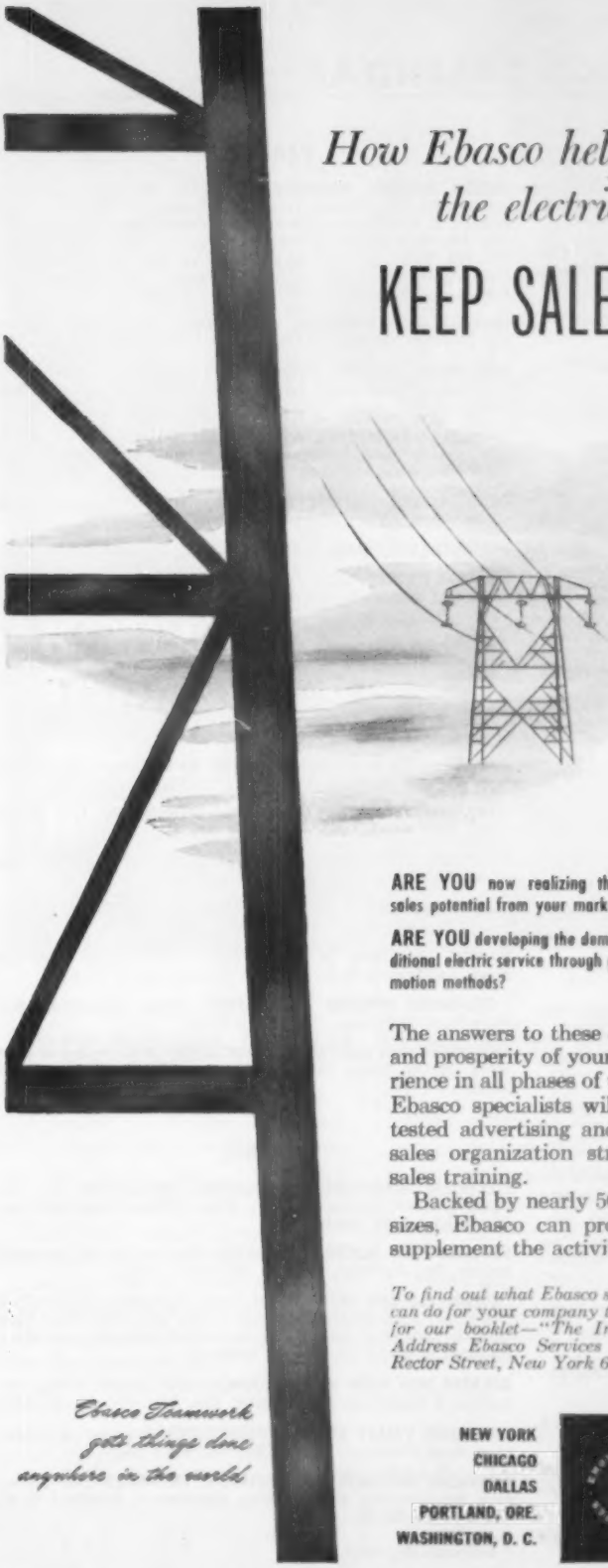
"If the American people are interested in having government administered for the welfare of all rather than for the benefit of a privileged few, (they should) investigate the favored status of . . . the 20% minority who are being furnished subsidized, and therefore underpriced, power by tax-exempt and governmentally-favored power organizations. . . ."

This was the theme of an address given recently by Harllee Branch, Jr, Edison Electric Institute president, to Indiana Electric Association convention at French Lick. His speech was answer to Harry Truman who spoke from the same platform six weeks earlier.

Urging a unified program to resolve the "public vs private" power controversy, he stated we must "no longer remain silent in the face of unjustified attacks upon our industry or upon the interests of the majority of Americans who are served by our companies . . . To fight privilege is in the American tradition."

How Ebasco helps
the electric power industry

KEEP SALES AT HIGH LEVELS



ARE YOU now realizing the greatest sales potential from your market area?

ARE YOU developing the demand for additional electric service through proven promotion methods?

ARE YOU using sales techniques that help keep the load evenly distributed throughout the year?

ARE YOU employing a program that will maintain favorable public opinion?

The answers to these questions are vital to the future growth and prosperity of your company. And Ebasco, with long experience in all phases of utility operation, is able to supply them. Ebasco specialists will study markets and trends, will offer tested advertising and promotion ideas, will help with your sales organization structure, public relations program and sales training.

Backed by nearly 50 years of association with utilities of all sizes, Ebasco can provide a skilled, objective viewpoint to supplement the activities of your own personnel.

To find out what Ebasco sales and public relations service can do for your company to keep sales at high levels write for our booklet—"The Inside Story of Outside Help". Address Ebasco Services Incorporated, Dept. M., Two Rector Street, New York 6, N. Y.

Ebasco Teamwork gets things done anywhere in the world

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EBASCO — ENGINEERS · CONSTRUCTORS · BUSINESS CONSULTANTS

Appraisal • Budget • Business Studies Consulting Engineering • Design & Construction • Financial • Industrial Relations • Inspection & Expediting Insurance, Pensions & Safety • Purchasing • Rates & Pricing • Research Sales & Public Relations • Space Planning • Systems & Methods • Tax • Traffic Washington Office

MEETINGS CALENDAR

NOVEMBER

INTER-INDUSTRY FARM ELECTRIC UTILIZATION COUNCIL—2nd Annual National Power Use Workshop, Chase & Park Plaza Hotels, St. Louis, Mo., Nov. 28-30.

AIR CONDITIONING & REFRIGERATION INSTITUTE—9th Air Conditioning & Refrigeration Exposition, The Auditorium, Atlantic City, N. J., Nov. 28-Dec. 1.

EDISON ELECTRIC INSTITUTE—Adequate Wiring Promotion, EEI Headquarters, N. Y., Nov. 30-Dec. 1.

WESTINGHOUSE ELECTRIC CORP—5th Annual Power Supplier Conference, Conrad Hilton Hotel, Chicago, Nov. 30.

* **AMERICAN MANAGEMENT ASSOCIATION**—Annual Finance Conference, Sheraton-Astor Hotel, New York, Nov. 30-Dec. 2.

DECEMBER

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS—51st Annual Meeting, Hotel Traymore, Atlantic City, Dec. 1-3.

EDISON ELECTRIC INSTITUTE—Commerical Division of Executive Committee, EEI Headquarters, N. Y., Dec. 2; Commercial Sales Group Electric Space & Air Conditioning Committee, Terrace Plaza Hotel, Cincinnati, Dec. 5-6; Commercial Sales Group Street Lighting Committee, Indianapolis, Dec. 6-7; Commercial Sales Group Cooking & Water Heating Committee, Hotel Statler, Boston, Dec. 7-9; Customer Accounting Committee, sponsored jointly with American Gas Association, Henry Grady Hotel, Atlanta, Ga., Dec. 8-9; Industrial Relations Committee, EEI Headquarters, New York, Dec. 15.

NATIONAL ASSOCIATION OF COST ACCOUNTANTS—Fairmount Hotel, San Francisco, Dec. 2-3.

AMERICAN WATERSHED COUNCIL, INC—Second National Watershed Congress, Statler Hotel, Washington, D. C., Dec. 5-6.

INTERNATIONAL EXPOSITION—25th Exposition of Chemical Industries, Convention Hall, Philadelphia, Pa., Dec. 5-9.

ELECTRIC COMPANIES ADVERTISING PROGRAM—Copy Group Meeting, Drake Hotel, Chicago, Ill., Dec. 7.

NATIONAL ASSOCIATION OF MANUFACTURERS—60th Congress of American Industry, Waldorf-Astoria, New York City, Dec. 7-9.

ENGINEERS JOINT COUNCIL—Nuclear Engineering & Science Congress, Public Auditorium, Cleveland, Dec. 12-16.

ELECTRIC COMPANIES PUBLIC INFORMATION PROGRAM—Steering Committee, Biltmore Hotel, New York, Dec. 13.

JANUARY 1956

WEED SOCIETY OF AMERICA—Charter Meeting, Hotel New Yorker, New York City, Jan. 4-5; Northeastern Weed Control Conference, Annual Meeting, Hotel New Yorker, N. Y., Jan. 6.

EDISON ELECTRIC INSTITUTE—Financing & Investor Relations Committee, Hotel Biltmore, New York, Jan. 19; Industrial Relations Committee, EEI Headquarters, New York, Jan. 19; Prime Movers Committee, Warwick Hotel, Philadelphia, Jan. 30-Feb. 1.

OKLAHOMA UTILITIES ASSOCIATION—Accounting Section, Alvin Hotel, Tulsa, Okla., Jan. 20.

AMERICAN SOCIETY HEATING & AIR CONDITIONING ENGINEERS—Annual Meeting, Cincinnati, Jan. 23-25.

NATIONAL RURAL ELECTRIC COOPERATIVE—14th Annual Meeting, St. Louis, Jan. 23-26.

AMERICAN MANAGEMENT ASSOCIATION—General Management Conference, Fairmount Hotel, San Francisco, California, Jan. 24-27.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Winter General Meeting, Hotel Statler, New York, Jan. 30-Feb. 3.

FEBRUARY

EDISON ELECTRIC INSTITUTE—Conference Planning, sponsored jointly with AGA, William Penn Hotel, Pittsburgh, Feb. 2-3; Transmission & Distribution Committee, Warwick Hotel, Philadelphia, Feb. 7-8; Electrical Equipment Committee, Homestead, Hot Springs, Va., Feb. 13-14; Commercial Lighting Committee, Hotel Shoreham, Washington, D. C., Feb. 15-16; Meter & Service Committee, Hotel Cleveland, Cleveland, Feb. 20-22.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Industrial & Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 2-3.

INDUSTRIAL ELECTRIFICATION COUNCIL—National Industrial Electric Heating Conference, Netherland Plaza Hotel, Cincinnati, Feb. 6-10.

PENNSYLVANIA ELECTRIC ASSOCIATION—Relay Committee, Benjamin Franklin Hotel, Philadelphia, Feb.9-10; Electrical Engineering Committee, Penn Harris Hotel, Harrisburg, Pa., Feb. 9-10.

SOUTHEASTERN ELECTRIC EXCHANGE—Personnel Administration Section, Buena Vista Hotel, Biloxi, Miss., Feb. 9-10.

ROCHESTER ELECTRICAL EXPOSITION—War Memorial Building, Feb. 18-25.

NATIONAL ADEQUATE WIRING BUREAU—12th Annual Conference, LaSalle Hotel, Chicago, Feb. 23-24.

AMERICAN SOCIETY FOR TESTING MATERIALS—Committee Week, Hotel Statler, Buffalo, Feb. 27-March 2.

MARCH

SOUTHEASTERN ELECTRIC EXCHANGE—23rd Annual Conference, Boca Raton, Fla., March 12-14.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS—12th Annual Conference, Hotel Statler, New York City, March 12-16.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION—Edgewater Beach Hotel, Chicago, March 12-16.

* **AMERICAN SOCIETY OF MECHANICAL ENGINEERS**—Spring Meeting, Multonomah Hotel, Portland, Ore., March 18-21.

ILLINOIS INSTITUTE OF TECHNOLOGY—18th Annual American Power Conference, Hotel Sherman, Chicago, March 21-23.

* **OKLAHOMA UTILITIES ASSOCIATION**—Annual Convention, Biltmore Hotel, Oklahoma City, March 22-23.

* **PACIFIC COAST ELECTRICAL ASSOCIATION**—Engineering & Operating Section, Palace Sheraton, San Francisco, California, March 22-23.

APRIL

ELECTRICAL MAINTENANCE ENGINEERS ASSOCIATION—8th National Biennial Electric Industry Show, Shrine Exposition Hall, Los Angeles, Calif., April 5-7.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering & Operation Section, Bon Air Hotel, Augusta, Ga., April 12-13.

* **EDISON ELECTRIC INSTITUTE**—National Conference of Electric & Gas Utility Accountants, sponsored jointly with AGA, Hotel Commodore, New York, April 16-18; Accident Prevention Committee, Sheraton Hotel, St. Louis, April 30-May 2.

GREATER NEW YORK SAFETY COUNCIL—26th Annual Safety Convention & Exposition, Hotel Statler, New York City, April 16-20.

* **MISSOURI VALLEY ELECTRIC ASSOCIATION**—Engineering Conference, Hotel President, Kansas City, Mo., April 18-20.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—2nd Conference on Recording & Controlling Instruments, Bradford Hotel, Boston, April 26-27.

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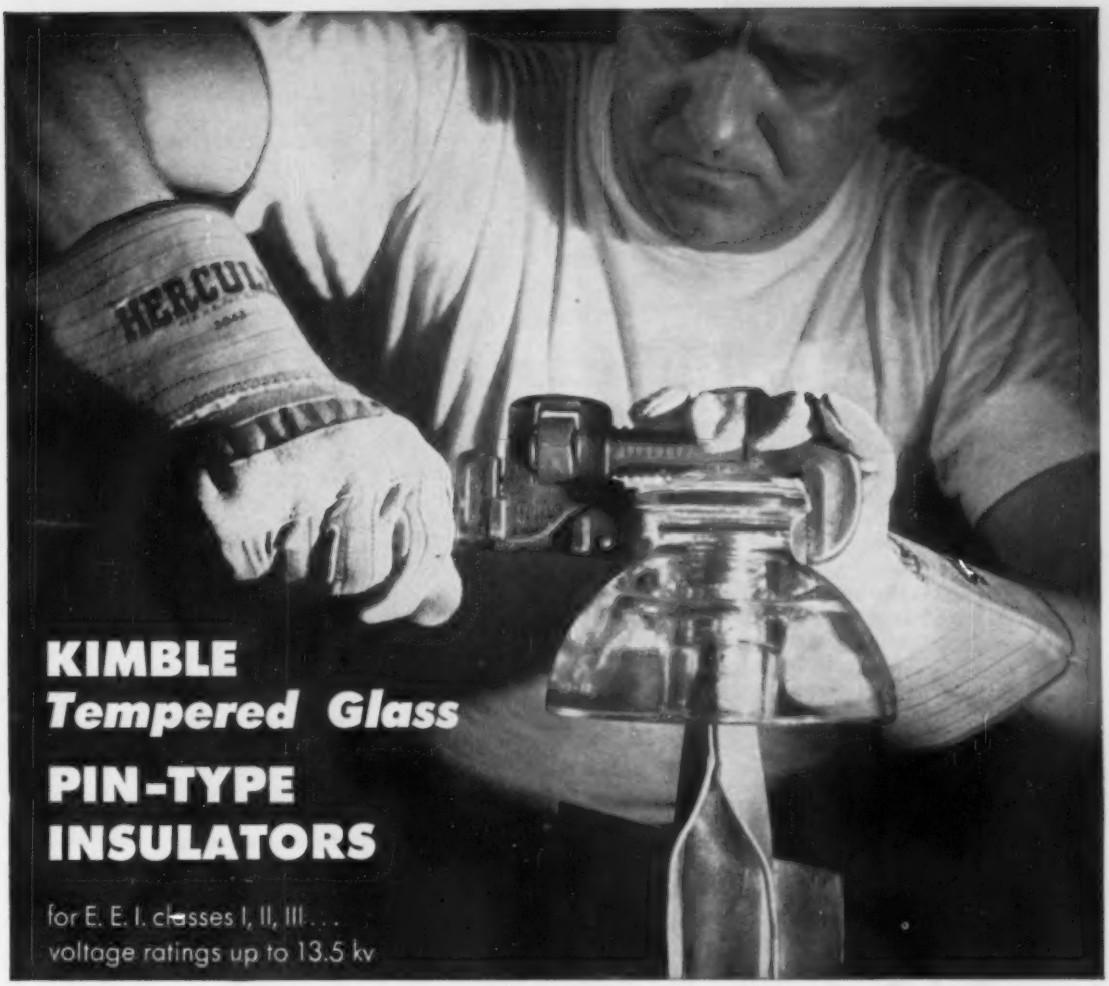
* Additions this week.



Stronger than the pin that supports it

SO STRONG . . . Torque test shows strength sufficient to strip threads on lead bushed pins and actually twist pole top steel pins.

This great strength saves installation time. It is not necessary to loosen Kimble tempered insulators for line-up with the conductor. Their strength will always allow another quarter-turn.

If it's on the pin, it's in service

In the event of shattering due to severe mechanical shock, insulator disintegrates into many small, non-sharp fragments. Trouble shooters can locate broken insulators—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. Kimble insulators are more than strong enough to meet the severe tests required.

Why not see how tempered glass can cut your line maintenance costs. Write for descriptive folder that gives complete details. Address: Kimble Glass Company, subsidiary of Owens-Illinois, **Dept. EW-11**, Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (I) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES • TOLEDO 1, OHIO

YOU SURE
SAVE TIME
on the purchase and installation of NELSON control boards....

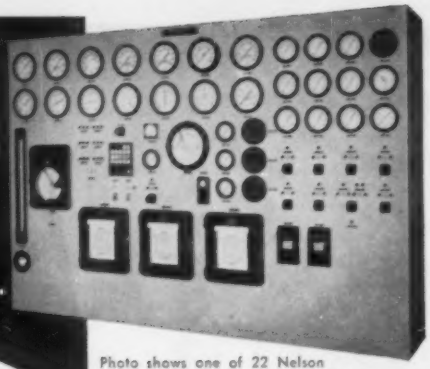
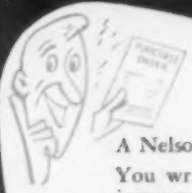


Photo shows one of 22 Nelson control boards which were recently built for a large utility.



A Nelson control board is a turn-key job.

You write *one* purchase order. We procure all of the instruments; do all of the sheet metal work, all of the welding, all of the wiring, all of the piping, and all of the testing.

The control board is shipped to your plant as *a completed assembly*. Installation time is reduced to a minimum. The next time you need a control board, let us quote on your requirements.

Write for Bulletin No. 712.

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

Remember . . . in the dynamic electric power industry, only World can do World's* work . . .* *Electrical World that is . . .

ANSONIA
Ankoseal Cables of Quality

• THE ORIGINAL ALL PLASTIC CABLE •

provide distribution circuits

deliver power to homes and factories

The quality of Ankoseal is insured by rigid controls during manufacture. The results are high dielectric strength, dependability, long service life and quality service at low cost. Made for aerial, duct and direct burial installations. *Write for information on specific installation requirements.*

THE ANSONIA WIRE & CABLE COMPANY
ANSONIA • CONNECTICUT

Fusion Process

(*Continued from page 65*)

J. N. Landis, Bechtel Corp, mentioned several factors that will effect the site selection, design, and construction of a nuclear power plant. Some of these factors are:

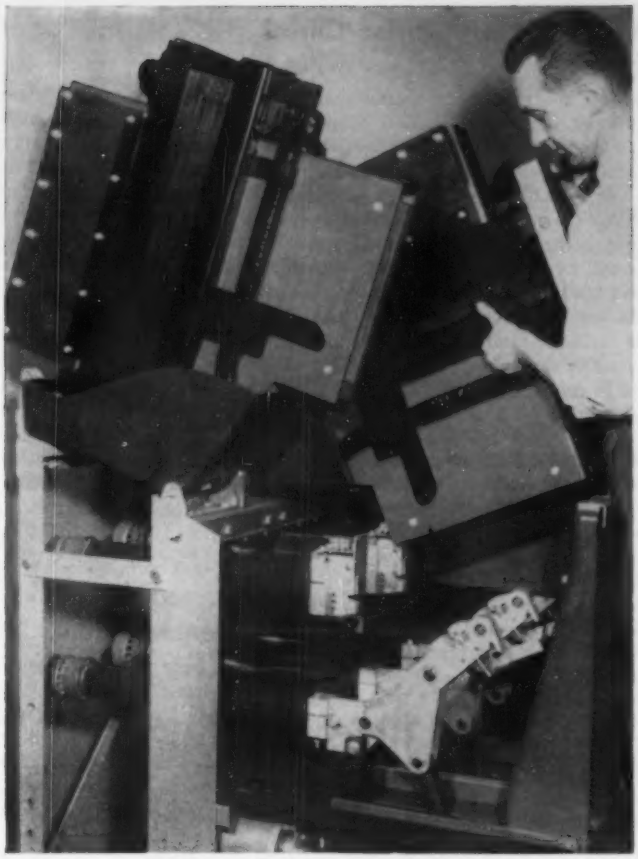
1. Inherent safety of the type of reactor chosen.
2. Type of plant enclosure.
3. Size of exclusion area.
4. Transmission line losses.
5. Water availability.

The last two are not new, but the first three are. He said that plant designers will not design reactors any more than they design boilers today, but their job of layout and design will be more difficult because of radioactivity. Control will be completely centralized with a great use of motor-operated valves. Ion exchange equipment for water purification will prevail and the fuel handling system will of course change radically. Stacks will still be required, in fact they will be higher because of the greater need to diffuse radioactive matter. Auxiliary power of the highest reliability will be required particularly after plant shut down to dissipate the heat caused by the residual reactivity of the reactor. Diesel driven power is suggested for this auxiliary power.

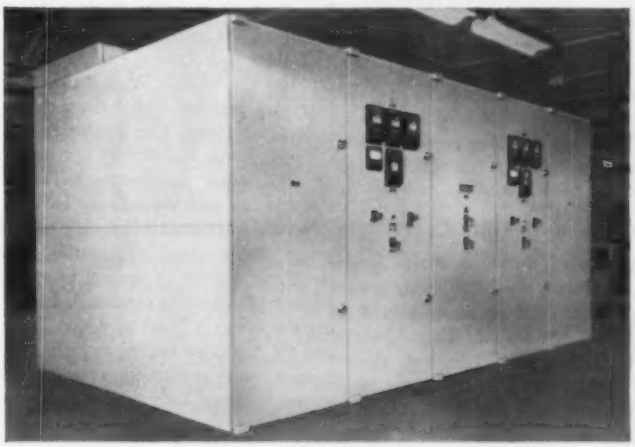
Construction forces also will have their problems. Because of the need to contain part or all of the equipment in some type of an enclosure, building a nuclear power plant will be much like installing the power plant aboard a ship. A great deal of planning and scheduling of equipment will be necessary to provide accessibility during construction; otherwise costs will rise greatly. Extreme cleanliness will be necessary because foreign matter left in pipes, vessels, etc, may have a detrimental effect as far as corrosion and radioactivity are concerned.

Installing Underground

Charleston, West Virginia, has a new look due to completion of Appalachian Electric Power Co's three-year, $2.5-million project to place all downtown electrical facilities underground. The power system, capable of delivering up to four times the present electrical demand, consists of underground ducts and transformer vaults with completely automatic transformers having a 50,000-kw capacity.



No cranes are required. Arc chutes pivot. Rest on fixed stop. Illustration shows 15 kv magnetic air circuit breaker.



I-T-E Switchgear in 15 kv rating. All I-T-E circuit breakers are horizontal drawout, interchangeable in like ratings.

TILTING ARC CHUTES

New I-T-E development for 15 kv air circuit breakers

The saving of time and effort which the new I-T-E tilting arc chutes make possible can best be appreciated by anybody who has ever removed the other kind. When inspection time comes, there's no crane lifting of heavy assemblies, no danger of dropping and damaging valuable parts. The arc chutes pivot back safely out of the way for easy inspection of contacts and arc plates. Only I-T-E makes magnetic air circuit breakers with this convenient, modern feature.

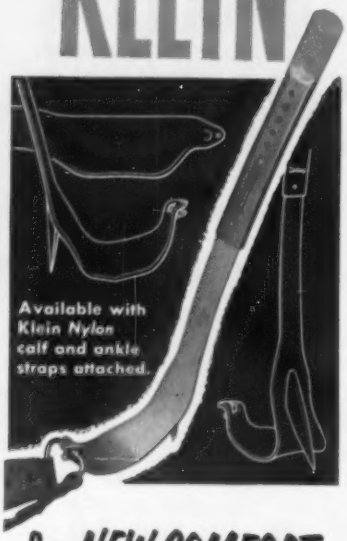
I-T-E Metal-Clad Switchgear is made in three basic ratings (5 kv, 7.5 kv and 15 kv), and will interrupt through 500,000 kva. Throughout the line, time-proved features add extra value. Circuit breakers are jig fitted to enclosures. Welded, rigid frames and housings can be lifted as a unit without losing alignment. Complete isolation of compartments insures safety and continuity of service.

Take advantage of I-T-E planning and engineering assistance when you order switchgear. It assures you protection with economy, plus better performance. For details, contact the I-T-E field office nearest you—look in your classified directory under "Electric Equipment." Or write for Bulletin 7004C. I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Phila. 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY Switchgear Division

Look to the Leader

KLEIN



for NEW COMFORT
...NEW SAFETY

Meet the big new favorite—Klein Climbers fully shaped to the contour of calf and ankle. That means a firmer, closer fit . . . a greater measure of safety. There's a new shape to the extra-wide stirrups also, for more comfortable arch support. Klein Climbers are made of forged steel, individually tempered and tested—aluminized for weather protection. Matched in pairs—adjustable length patterns 15 to 18 inches, specify 1945-ADJ—fixed length patterns 15 to 18½ inches, stock sizes specify 1945.

KG NO. 1 GAFF GAUGE
Keep this precision gauge handy for a safety check on proper spur shape. Plated steel—packed in durable plastic case.

1901-MG GAFF GUARDS
Protect the all-important spur of your climbers with this new Klein gaff guard. First quality leather with spring clip.

Instructions for sharpening gaff included.

ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York.

Write for your free copy of the Klein Pocket Tool Guide today!

Mathias KLEIN & Sons
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS

Computer Makes Duration Curves

(*Continued on page* 73)

All following cards will have a ratio less than unity.)

3. Numbers serially each card in order, punching card number in columns 52 to 55, and

4. Checks the calculations made.

At the end of the run the top card in the deck will have 000 in columns 49 to 51 and 0001 in columns 52 to 55 while the last card will have in columns 49 to 51 the ratio of the lowest hourly load to the annual maximum and 8760 in columns 52 to 55.

Curve Points Selected

The 8,760 points for plotting a load duration curve have now been obtained. As use of that many points is impractical, only certain cards of the deck are chosen. These are pulled by hand. When a collator is available, however, a master pulling deck is prepared which can be used each time the job is done. It has been found practical to pull the first, tenth, 40th, 70th, each 100th, and the 8,760th card. The pulled cards are listed on the tabulator. Information found useful to engineers is the date, time of day, day of week, value of load in Mw including decimal fractions, and the serial number which represents the number of hours this load was carried.

When there is reason for plotting a load duration curve against percentage of time, rather than actual hours, a master deck, having punched therein the percentage of time corresponding to number of hours, can be used to pull the cards. The essential data from the pulled cards are then reproduced into the master deck cards which are listed on the tabulator.

How to Make Monthly Curve

When a load duration curve for August is desired, the 8,760 cards are put in a sorter, and all cards with 8 in column 2 are pulled. These 744 cards (one for each hour of the month) are arranged by the sorter in descending order of the load values. The top card, the maximum load for the month, is then identified by punching a control X in column 78. The calculator and tabulator routine is the same as for the annual curve, except that the ratio is punched in columns 56 to 58 and the card serial number is in columns 59 to 62.

The card layout provides four positions for a control X. Actually these punched holes can be placed anywhere, even over other holes. For example, when company A wanted its own set of duration curves, the control X might have been put in column 8 over the first digit of the load value. Space has been provided to show one set of ratio and serial numbers for each company. Usually further analysis of individual company data is unnecessary.

This article has dispensed with descriptions of planning charts and wiring diagrams for the machines mentioned on the assumption that each utility has one or several persons skilled in wiring and operating them.

Group Formed to Study Atomic Reactor Plants

An atomic power engineering research group has been organized by Sargent & Lundy, Engineers, Chicago, and 14 public utility companies. Key activities will include a detailed analysis of various reactor designs, technical characteristics, operating problems, and suitability for application to power systems.

The participating utilities are Central & South West Corp; Central Illinois Public Service Co; Central Louisiana Electric Co; Central Power & Light Co; Cincinnati Gas & Electric Co; Interstate Power Co; Kentucky Utilities Co; Middle West Service Co; Northern Indiana Public Service Co; Otter Tail Power Co; Public Service Co of Indiana, Inc; Public Service Co of Oklahoma; Southwestern Gas & Electric Co; and West Texas Utilities.

At the recent first meeting of the group, the nuclear, engineering, and economic aspects of several proposed reactor plants were discussed, including the Borax-3 Plant at Arco, Idaho, and the 5,000-kw boiling experimental reactor under construction for the Argonne National Laboratory.

Plans Atomic Power Plant

Atomic power plans have been announced by Holyoke (Mass.) Municipal Gas & Electric Department, which says it will seek Atomic Energy Commission approval for a nuclear plant.

Substation Costs

(*Continued from page* 75)

should be less because only one-third as many breakers are used. But this advantage is offset by the complex relaying required with the one-breaker plan.

If infrequent bus and transformer outages (once every 8-11 years) can be tolerated, omitting the tie breaker (Scheme D) saves considerable money. This protects the load against transmission line outages but leaves the station unprotected for trouble on the station high tension bus or in either transformer. The latter fault can be localized by adding transformer breakers (Scheme E) but at great expense and for very little advantage (because of reliability of transformers mentioned above).

Primary Network Scheme

Another approach (Scheme F) is not to provide any breakers on the high voltage side at the station. Transformer protection may be achieved by fuses or grounding switches. This is the least expensive method but would result in the loss of the entire station for any fault or on either transmission line, in the transformers, or the high voltage bus. This scheme is used extensively to supply primary networks where service continuity is provided by duplicate substations.

At the smaller radial stations adequate service may be maintained by manual transfer of the load, either to the alternate transmission in the station, or to adjacent stations by means of field switching on the distribution circuits. In case of a transformer failure a system spare transformer or a mobile substation unit may be used until permanent repairs can be made.

Cost and Reliability Govern

No one scheme can be recommended universally. Different situations and requirements should be met by the most economic means consistent with reliability requirements. The above analysis indicates that the use of high cost circuit breakers can be kept to a minimum even in situations where a high degree of service continuity is required.

Keeping track of the changes in the relative cost of protected and protecting equipment is an aid to this analysis. Of equal importance are the records of fault interruptions according to type.

fast way to figure cable terminating needs

UNIT PACKAGE TERMINATING KITS FROM

PLM

UNIT PACKAGE TERMINATING KITS FOR:

ARMORED CABLE

•

RUBBER INSULATED CABLE

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LEAD COVERED CABLE THROUGH 23 KV

● Be sure of the right materials, in the right amounts, in the right places, for every termination to be made in cable runs! PLM Unit Package Terminating Kits simplify planning...eliminate endless details in specifying, ordering and stocking. Each Kit contains detailed instructions and correct materials for terminating one cable of specified rating and type.

ONE order from PLM can take care of ALL your terminating or splicing needs. Ask for catalog or quotations.

PLM Products, Inc.

3873 West 150th St. • Cleveland 11, Ohio

WIRE AND CABLE FITTINGS AND ACCESSORIES

Armored Cable Terminators • Splicing and Terminating Kits • Conduit Ventilators

?

WHAT'S NEW? ●

We're interested . . . and so are Electrical World's readers! Are you all steamed up about your new product, new plant or expanded facilities? Got some red-hot new literature, research results or a new production method? Any financial, product design changes —shifts in executive personnel—consolidations? Whatever you have, *World* makes it easy to bring it to the reader's attention. Write for the booklet . . . *"How To Get Maximum Value Out of The News Releases You Write For Electrical World."*

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant
Positions Wanted
Part Time Work

Civil Service Opportunities
Selling Opportunities Wanted
Selling Opportunities Offered

Employment Agencies
Employment Services
Labor Bureaus

DISPLAYED —RATES— **UNDISPLAYED**

The advertising rate is $19.15 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$1.50 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

Box Numbers—counts as 1 line.

Discount of 10% if full payment is made in advance for 6 consecutive insertions.

Not subject to Agency Commission.

Send NEW ADS to ELECTRICAL WORLD, 330 W. 42nd St., N. Y. 36, N. Y., for December 12th issue closing December 2nd

POWER PLANT PERSONNEL

A middle east coast utility now constructing a new high pressure, pulverized fuel generating station will accept applications for employment from qualified persons for the following positions, which are available immediately:

Results or Test Engineer

Must be graduate mechanical engineer or equivalent, with experience in modern power plant operation and three years in a responsible supervisory results position. Will be required to assume full charge of power plant testing, chemical control, accounting and research.

Assistant Results or Test Engineer

Graduate mechanical engineer or equivalent, with experience in power plant test and technical work. Will conduct tests and research and maintain records under direction of the Results Engineer.

Job is located near excellent residential community, good working conditions, forty hour week (paid vacations, insurance, sick pay and retirement plan).

High caliber men are needed to fill the foregoing jobs, and for applicants meeting the above requirements, consideration will be given to reimbursement of expenses incurred for moving of household goods and personal effects.

Personnel selected will receive training at full pay in order to familiarize themselves with the plant before assuming their duties. Include a complete resume of experience and qualifications in first letter. All applications will be treated confidentially.

P-8298, Electrical World
330 W. 42 St., New York 36, N. Y.

UTILITY EXECUTIVE ENGINEER

LOCATION: Fast growing electric utility company in a large, progressive city in Florida, the nation's number one state in rate of industrial growth, and number two state in population growth.

RESPONSIBILITIES: Management of all engineering operations of company. Supervision and training of engineering department.

EXPERIENCE: Diversified engineering background in electric utility company, including a minimum of three years supervising engineers. Individual must have leadership ability, with potentiality for further advancement. Ability will be regarded as of greater importance than just years of experience.

AGE: 35-45 desirable.

SALARY: Commensurate with the high level qualifications demanded by the position.

REPLY: Confidentiality assured. Write, giving summary of qualifications to

P-8303, Electrical World
330 W. 42 St., New York 36, N. Y.

WANTED
ELECTRICAL UTILITY ENGINEER
WITH DISTRIBUTION EXPERIENCE
Write:
Chief Electrical Engineer
CENTRAL ILLINOIS
PUBLIC SERVICE COMPANY
SPRINGFIELD, ILLINOIS

JUNIOR DISTRIBUTION ENGINEER

Electric utility serving in the East desires a graduate electrical engineer with some experience in the distribution field, preferably with a public utility. Permanent position—salary dependent on experience and ability. Applicants please include complete resume of experience and qualifications.

P-8221, Electrical World
330 W. 42 St., New York 36, N. Y.

EXECUTIVE TYPE SALES REPRESENTATIVE *WANTED*

Excellent opportunity for aggressive man to join large manufacturer expanding in field of preservatively treated forest products. Domestic and foreign distribution. College degree in Engineering and/or experience in this field preferred. Age 28 to 35.

All replies in confidence.

Address—Sales Representative,
P. O. Box 1426, Houston 1, Texas.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1111 Wilshire Blvd. (17)

POSITIONS VACANT

Plant Accountant and Valuation Engineer. Supervisory position open on staff of mutual service company for electric utilities located in the southeast for engineer with valuation and plant accounting experience. Reply stating age, education, experience, personal particulars and minimum salary expected. P-8007, Electrical World.

Electrical Engineer as Assistant Superintendent for Midwest Municipal Electric and Water Utility. Experience in design, planning and operation of 2400/4160 volt distribution systems. Knowledge and experience in steam generation plants desirable. Excellent opportunity for advancement. Age 32-45. P-8215, Electrical World.

Electrical Engineer—Graduate—2 to 5 years experience—protective relay work with electric utility. Permanent position long established supervisory-consulting organization. Headquarters New York. Some travel Latin America. Salary commensurate with experience. Reply stating age, education, experience, personal particulars and minimum salary expected. P-8453, Electrical World.

Young Electrical Engineer—Power Option— Recent graduate or man with 1 or 2 years experience. Good opportunity. Permanent position with long established electric utility in Costa Rica. Knowledge Spanish necessary. Reply stating age, education, experience, personal particulars and minimum salary expected. P-8456, Electrical World.

POSITIONS WANTED

Junior Electrical Engineers—Five graduates for power stations and substation electrical design. Location New York with established Service Organization for a large group of electrical utilities. Requirements: 1 to 3 years with leading electrical equipment manufacturer, G.E. or Westinghouse test course, or actual electric design, operation, construction experience on steam, diesel or hydro plants and substations. Limited foreign travel possibilities in future. Reply stating age, education, experience, personal particulars, and minimum salary expected. P-8449, Electrical World.

Position open for General Sales Manager of medium size, midwestern, combination gas and electric utility. Will have complete charge of merchandise sales and new business activities. Liberal salary and good advancement prospects. P-8370, Electrical World.

EMPLOYMENT SERVICES

Salaried Personnel. $5,000-$30,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and adddress only for details. Personal consultation invited. Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

POSITIONS WANTED

Distribution Engineer; supervisory experience. Graduate E.E., May, 1949, age 28. To locate central or western U. S., utility or manufacturing. PW-8333, Electrical World.

Operations Superintendent Electrical engineer, age 34, 8 years excellent record with present medium sized utility, 5 as division superintendent, desires opportunity with a challenge. Proven administrative ability covering design, construction, operation, and maintenance of substations, transmission, and distribution. PW-8269, Electrical World.

SELLING OPPORTUNITY WANTED

Manufacturers' Agent covering utilities, contractors, industrials, wholesalers, government, in DC-MD.-Va. desires additional account. RA-8227, Electrical World.

Don't forget the
Box Number

WHEN answering the classified advertisements in this magazine, don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

CLASSIFIED SEARCHLIGHT SECTION ADVERTISING

BUSINESS OPPORTUNITIES — EQUIPMENT - USED or RESALE

UNDISPLAYED RATE:

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PROPOSALS, $1.50 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:

The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

SEND NEW ADVERTISEMENTS TO: 330 W. 42 ST., N. Y. 36, N. Y., for December 12th issue closing December 2nd

ELECTRICAL WIRE AND CABLE

—YOUR BEST SOURCE—

• for every industrial and power application
• Odd lengths—long and short—reasonably priced

One of the Largest Stocks in the Midwest

Let us quote on requirements—
send your inquiries
We'll also buy your Surplus

Branch Offices:

Houston— Walnut 3-4580
Los Angeles— ANgeles 3-5148

FOR YOUR TEMPORARY NEEDS TRY OUR SURPLUS DIVISION

UNIVERSAL Wire and Cable Co.

2664M N. Clybourn Ave., EAstgate 7-4777
Chicago 14, Ill. Code: UNIWIRE

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Contact The McGraw-Hill Office Nearest you.

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P. McPHERSON

CHICAGO, 11
520 No. Michigan Ave.
MOhawk 4-5800
H. BOZARTH
W. HIGGENS

CLEVELAND, 15
1510 Hanna Bldg.
SUperior 1-7000
C. J. LOUGHLIN

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JEfferson 5-4867
H. BOZARTH

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R. ALCORN
T. CARMODY

PERIODICALS

A.I.E.E. transactions back-volume wanted to buy for cash. Ashley, 27 E. 21, N.Y.C. (10).

OFFICIAL PROPOSALS

Bids: December 26, 1955

Power Authority of the State of New York

ST. LAWRENCE POWER PROJECT
ADVERTISEMENT FOR PROPOSALS
FOR
THE FURNISHING AND DELIVERY OF EMERGENCY DIESEL-GENERATOR SET AND APPURTENANCES
SPECIFICATIONS NO. PA-5-14027
ST. LAWRENCE CONTRACT NO. P26

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the design, manufacture, and furnishing of one (1) stationary emergency diesel-generator set and appurtenances and delivery thereof f.o.b. cars at destination, in the following ways:

(1) If brought in person on the day of receiving bids, until 2:30 P.M. Eastern Standard Time on the 6th day of December, 1955, Hearing Room C on the 6th floor, 270 Broadway, New York, New York.

(2) If mailed in, until 2:15 P.M. Eastern Standard Time on the 6th day of December, 1955, at the Authority's office, 270 Broadway, Room 1300, New York 7, New York.

The proposals will be publicly opened and read aloud at the time and at the address given in (1) above. Bids will be entertained for the emergency diesel-generator set, appurtenances and services in accordance with the bidding schedule. Erection at the site of installation will be done by Others but services of erecting engineers shall be provided by the manufacturer if and when required. Delivery of the diesel-generator set will be required by April 1, 1956.

Plans, Specifications and Proposal Forms for the work will be on file in the Authority's office and in the offices of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, may be inspected by prospective bidders during office hours, and may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York upon application and prepayment of a fee of Ten ($10.00) dollars per initial set of contract documents and Five ($5.00) dollars per set for additional sets, no part of which will be refunded. Two sets must be returned with each bid.

Bids will not be restricted to American manufacturers.

Bids must be made in duplicate upon the proposal forms included in and bound with the Contract Documents. A bid deposit will be required with each bid in an amount not less than 10 percent of the gross sum bid.

The right is reserved to reject any or all bids.

W. S. CHAPIN
GENERAL MANAGER

PA-5-14027
11/10/55

TRANSFORMERS

FOR SALE

3—1000 Kva Mol. 11500-2400/4160Y
3— 500 Kva W-H 33000-2300/2400
3— 500 Kva G-E 22000-2300/4000Y
5— 333 KVA W-H 38000-7200/12470Y
3— 333 KVA G-E 33000-2300/4000Y/6900/11950Y
3— 333 KVA G-E 7200/12470Y-2400/4160Y
3— 250 Kva G-E 2415/2300-600
6— 200 KVA G-E 13200-2400/2300
6— 100 KVA G-E 13200-230/460
1—1500 KVA W-H 34500-2400/4160Y 3-ph., with substation equip't

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.

5316 Hetzel St.
Cincinnati 27, Ohio

40 Years' Dependable Service

DIESEL ELECTRIC POWER

Stationary—Portable—Mobile

100 KW to 1500 KW

Engineered Diesel Power

"Union Light & Power Company" Cabs.

A. G. SCHOONMAKER COMPANY, INC.
Box 516, Sausalito, Cal.
50 Church St., New York 7, N. Y.

Save Money — Save Time

Contact us for prices, on large power equipment of all kinds. Prompt shipment from inventory. Send for our complete catalog.

BELYEA COMPANY INC.
51 Howell St. Jersey City, N. J.

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE — Two Rector St., New York 6, N. Y.

How Hearings Boomeranged

Chudoff committee investigation's one-sidedness is turned against its sponsors by prompt action from Harllee Branch

Prompt and bold action in the face of false accusations by federal power forces can be effective. This is clearly demonstrated in a review of the developments surrounding the recent Chudoff hearings as they dealt with the Clark Hill controversy in Georgia.

The story as it is revealed in retrospect could have been entirely different were it not for the quick and aggressive outspokenness of Harllee Branch, Jr, president of Georgia Power Co.

The latest phase of the long-standing Clark Hill controversy can probably be opened with the testimony of Alex Radin, general manager of the American Public Power Association on Aug. 11 of this year before the Chudoff committee. At that time Radin said:

"In the Southeast the rights of preference customers are being jeopardized because of the unwillingness of the Georgia Power Co to sign a wheeling contract with the Department of Interior whereby power from the Clark Hill Dam could be furnished to the preference customers."

Sequence of Events

Following this, the sequence of events took this course:

Sept. 2: Under chairmanship of Rep Earl Chudoff (D-Pa.,) the House subcommittee on public works and resources opened hearings in Atlanta, Ga. The same day Branch issued a statement to the press stating that Georgia Power had been refused the right to testify at the hearing. He noted that the subcommittee said it might hear the company in Washington in November or December. But, said Branch, that will be too late. "By then the public will have formed its judgment, and our defense is likely to be neither newsworthy nor of interest." This statement, which also pointed up the evident bias in the hearings, was widely carried in Georgia papers and others as part of their Chudoff reports.

Sept. 3: News reports of the Chudoff hearings were still quoting the Branch statement thus counterbalancing the attempts at turning the hearings into a one-sided propaganda offensive.

Sept. 4: Chattanooga (Tenn.,) Sunday Times while editorializing on the hearings in a manner favorable to the public power groups nevertheless again quoted from Branch's statement and said this: "Certainly, Congressional committees should hear both sides." The Augusta (Ga.,) Chronicle in a stronger editorial on the side of private enterprise noted "the real bias (of the hearings) came out when the committee refused to hear spokesmen of the Georgia Power Co."

Oct. 12: Back in Washington again to continue his hearings, Chudoff was quoted in newspapers as accusing Georgia Power of seeking "blackjack" provisions in the Clark Hill contract. Promptly Branch issued a statement setting the record straight and relating step by step what Georgia Power had done in an effort to resolve the difficulty.

Oct. 13: Branch issued an additional statement answering insinuations made by Chudoff regarding a White House Conference on the Clark Hill matter. The statement gave complete details of the White House discussion with Presidential advisor Sherman Adams, pointing up the inconclusiveness of the half-hour visit; whereas Chudoff had implied it resulted in preferential treatment for the company.

Branch Again Denied Hearing

Oct. 18: Branch again issued a strong statement in response to a further denial by Chudoff to permit the company to testify at the hearings. Branch expressed his "shock" at the "high-handed and un-American treatment of my company, and I believe fair-minded Americans everywhere will condemn this decision."

Oct. 20: The Washington Post came out with its strong editorial accusing the Chudoff committee of bias in its hearings (EW, Nov. 14, p 112). The Rome (Ga.,) News-Tribune also editorially condemned the hearings for bias, citing the Georgia Power position.

Oct. 26: The Washington Post printed Chudoff's letter clearing Georgia Power of "improper action or influence" (EW, Nov. 14, p 112).

Oct. 27: Branch made a statement expressing gratitude for Chudoff's admission clearing the company but noting that the company nevertheless "has suffered irreparable damage on account of careless and baseless insinuations." This statement was carried at length by these Georgia papers: Atlanta Constitution, Macon Telegraph, Columbus Enquirer, Savannah Morning News, Augusta Chronicle, Thomasville Times Enterprise, Daily Tifton Gazette, and Brunswick News.

Oct. 28: Many of the foregoing papers editorialized on the hearings under such headings: "Better Late Than Never, Chudoff Clears Up Who is Being Probed"; "Unjust Smear"; "Power Tie-Up Penalizes State"; "Biased Attack on Georgia Power"; and "Unfair Tactics By Public Power Proponents."

Branch's prompt repudiations, as the foregoing shows, paid handsome dividends.

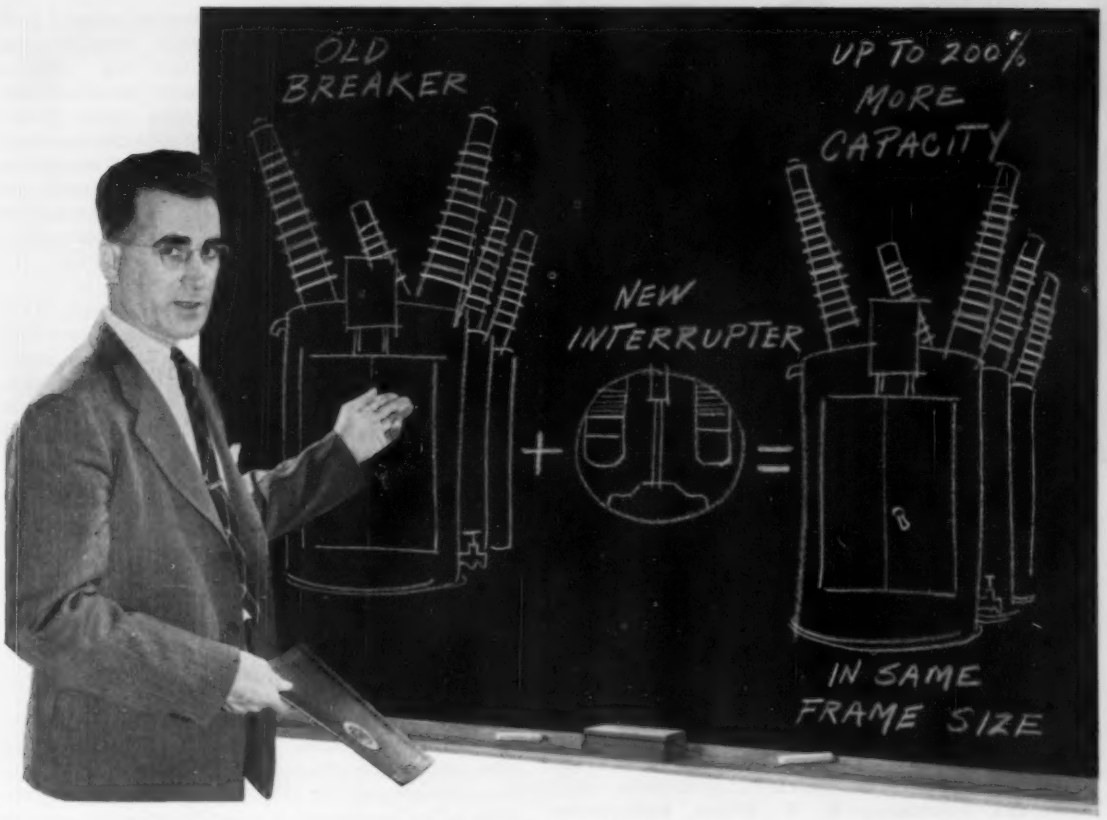
ECAP Seeks TV Show For 1956 Sponsorship

The Electric Companies Advertising Program, relinquishing its sponsorship of "You Are There" on television, is actively searching for a new program for 1956.

Discussions on a new vehicle for ECAP sponsorship have been held with all major networks and with many independent producers.

The companies, however, have certain difficulties not common to other sponsors of a weekly television show. Since sponsorship will be on alternate weeks, an alternate sponsor must be found; the program must be at least partly owned by ECAP to give members companies the effect of local ownership through local sponsorhsip; and finally, budget limitations and the fact the programming costs have risen 140-150% in the past five years.

A number of possibilities have been investigated, including a dramatization of O. Henry stories, but have had to be rejected. However, consummation of a contract is expected shortly.



J. W. Sterling, Power Circuit Breaker Sales Manager, advises . . .

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PSYCHOLOGY HELPS SELECTION of system operators, Dr. J. R. Porter tells Interconnection Chairman A. L. Richmond, Committee Chairman Montgomery, Section Vice Chairman Kocsan

PEA Promotes Progress

(*Continued from page* 61)

accordance with seasonal load requirements if interconnections are to contribute optimum economies. Rising summer loads will force scheduling some maintenance during winter peaks. Some utilities may be forced to boost reserve to permit this change. And the economic loss for outage of efficient units is enough to justify round-the-clock maintenance—**H. W. Phillips, Pennsylvania-New Jersey Interconnection.**

Scheduling of maintenance by North Central Area utilities was developed to a system during the war. Mechanism for this was coordinating meetings at which each utility submitted estimates of seasonal capability, expected weekly peaks, reserves, and scheduled outages during peak periods. Schedules were then arranged to provide optimum reserve margins in each local area. Forced outages were offset by postponing scheduled maintenance on other units in the interconnection—**W. R. Hamilton, West Penn Power Co.**

Maintenance scheduling in Upstate New York starts in September for the following year. Preliminary information as to capacity curtailment, required work and estimated duration, and the preferred time is coordinated with predicted reserve margins to preserve system economy and reliability. Hydro capacity during the spring permits simultaneous outage of three large steam units. Hydro units are maintained during low-water periods. Work is pushed on a 6-day 20-hour basis. Units out for maintenance average 6.5% of capacity—**E. L. Hoffman, Niagara Mohawk Power Corp.**

Electrical Equipment Committee
New York, N. Y., Oct. 27-28

Safety begins with design of equipment and structures and the methods required for construction. Maintaining all points to 8 ft above the foundation at ground potential permits personnel to walk safely in substations. Air break switches should be selected which cannot fall closed if their operating mechanism becomes disengaged. Every building involving any hazard should have two exits. One-line diagrams should be kept simple and design should make the one-line clearly evident in the completed station. Preassembly of elevated structures contributes to erection safety and economy. Grounding should include grids where men operate gang switches and a buried conductor outside the fence to protect the public. And use of mobile substations permits completely de-energizing a substation for maintenance—**R. C. R. Schulze, Atlantic City Electric Co.**

A survey of 17 utilities discloses that the majority apply 3 to 4 in. of broken stone, usually ¾-in. size, to substation yards and occasionally surface it with about ¼-in. stone. Roadways usually get 6 to 8 in. of 2 to 2½-in. broken stone, often surfaced with ¾-in. stone. Many utilities place this stone under oil-filled equipment to reduce fire hazard —**M. C. Galiyano, Pennsylvania Power & Light Co.**

Nuclear power plants will cease to hinge on economics but will be required to serve soaring demands. But the steam turbine will remain "king." Pressures will rise to 7,500 psi and temperatures to 1,300F, but the 2,500 to 4,000-psi band will be avoided. Super-critical turbines must be upwards of 200,000 kw for maximum efficiency, but higher hydrogen pressure will hold down unit weights and dimensions—**W. L. Gardner, Westinghouse Electric Corp.**

Eighty-five percent of large transformer installations recently have been 3-phase. And reduced BIL has featured 100% of orders at 230 and 330 kv and 77% at 138 kv. Future transformers up to 40 Mva and 115 kv may use 30-psi sulfur hexafluoride as a coolant giving heat transfer equal to oil and remaining inert at 300 to 400 F. Freedom from fire hazard would permit installation inside the plant near the generator for added economy—**L. H. Hill, Jr, General Electric Co.**

Revision of the test code to place low-frequency test voltage closer to normal voltage can cut power transformer cost and weight by 10%. The transformer would still have BIL to withstand lightning and system surges when protected by modern lightning arresters—**J. R. Mann, Allis-Chalmers Mfg Co.**

Increasing size and weight of station equipment has forced construction of a 150-ton 16-wheel trailer with an 8-wheel dolly. Towing power is a 275-hp 10-wheel tractor. A walking-beam extension transfers ⅓ the trailer load to another tractor coupled to its rear. Thus coupled, the 118,000-lb rig can haul loads in excess of 214,000 lb without exceeding 800 lb per sq in. of tire—**John F. Calhoun, Philadelphia Electric Co.**

Sealed storage batteries eliminate need for battery rooms, saving space, eliminating the explosion hazard, and facilitating maintenance. But they are inspected and cleaned every two years to check connections and guard aganist corrosion—H. R. Paxton, Philadelphia Electric Co.

Polyethylene cable is well accepted by industrials in the 5 to 15-kv class. Localized ionization blocks higher voltage designs, but irradiation will give it a much higher melting point—**E. D. Eich, Anaconda Wire & Cable Co.**

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WASHINGTON COMMENT

Power Issue Will be Local in 1956

Neither Republican nor Democratic politicos see much chance of exploiting federal power issues in election campaigns but may try in scattered areas

The battle for Congress is shaping up, according to tradition, almost a year to the day before next year's elections. With this development the importance of electric power as a campaign issue comes into question.

The Eisenhower Administration has made a good record for itself in this field. Standing on this record will be, not only the Republican nominee for president, but also several nominees for the Senate and a number of candidates for the House.

The record consists chiefly of the Administration's—and its Congressional backers'—positive stand in favor of local-federal "partnership" development of the nation's water resources, and opposition to complete federal development.

Who Is Against Partnership?

The partnership approach to power planning has been one of the most controversial issues brought before the Congress in the last two years. There is a sizable school of Republican thought which believes the policy has done the party more harm than good, and, of course, the many Democrats are sure of this. Republicans who do not share this view may include it among the planks on which they will base their reelection campagins; the others will ignore partnership as much as possible.

What will the Democrats do?

Nationally—that is, insofar as the presidential campaign is concerned and insofar as the party's overall campaign is aimed at Congressional seats—they will gloss over power as an issue except in two instances. The exceptions are Hells Canyon and Trinity River.

In their two-year fight against licensing of Idaho Power Co to develop the Hells Canyon stretch of the Snake River in Idaho, Democrats suffered a severe setback. The company was licensed. Democrats' aim will be to turn a great deal of heat on this license in the hope that they can reelect Idaho's Gracie Pfost and defeat Montana's Orvin B. Fjare and Oregon's Sam Coon in the House. All these seats are marginal. That is, each was won by less than 55% of the votes in each district. These are the seats for which both parties aim, on which they lavish the most in terms of time, money, and effort.

Hells Canyon will be plugged hard in these three states. It may, in fact, emerge as the biggest issue locally. The subject will also be fed into the headlines in other areas as Democrats campaign, but in these cases mention will be made of Hells Canyon primarily for its effect "back home" in Idaho, Montana, and Oregon.

Trinity River May Figure In

Trinity River, too, will receive this treatment, according to present Democratic plans. While none of the marginal seats, six Republican and one Democrat, border immediately on the project, the state is caught up in a bitter feud with its upstream neighbors over disposition of Colorado River water; and the subject matter is a natural.

But, rough though these two fights may be, the fact remains that power as a national political issue next year is out. Democrats, despite their uproar for the last couple of years, don't have much hope of making real political capital out of it. The Republicans see little of dramatic importance in it. Insofar as Congress is concerned, the issue will be raised in few contests. But across the nation as a whole, far more basic economic issues will rule—issues where the effect on the voters' pocketbooks and way of life can be felt right now.

TECHNICAL NOTES

Compression joints on clean new ACSR remain good after 30 yr while newer joints made to repair or re-route the old conductors overheat unless proper care is given to cleaning and installation.

Silica deposits in turbine passages can be minimized by injecting treated feedwater directly into the boiler primary steam drum to lower salt concentration in the area where most of the steam is generated.

Faults on subtransmission lines may cause momentary interruptions to connected customers. But they cause voltage dips to annoy many others served by unfaulted lines in the interconnected system.

Turbines are covered with ornamental casings. Omission might bring unexpected benefits in accessibility to fight fires under the machines or in lagging saturated with leaking oil.

High intensity mercury lights blacked out by a 2-cycle interruption require 8 min to light again.

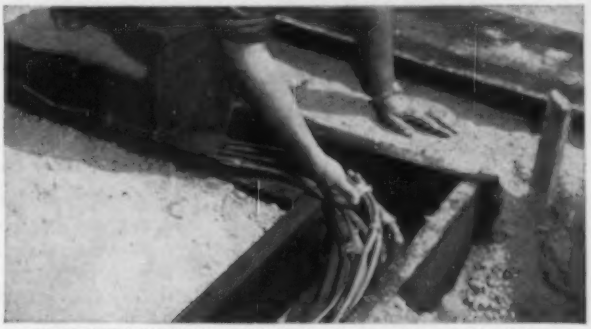
Notches or sockets at frequent vertical intervals in plant columns facilitate insertion of brackets to hold scaffolding for repair and maintenance operations.

Thorium will be a more valuable reactor fuel than uranium when methods are developed to extract it with suitable high purity from monazite.

Sensitivity of automation to voltage dips can be relieved by eliminating unnecessary sensitivity from voltage-actuated controls.

NEOPRENE RESISTS WEATHERING. Cable leading to conduit at relay house is exposed to rain, snow, temperature extremes and ground drainage. Durable neoprene jacket protects cable and adds years of extra service life.

NEOPRENE RESISTS OIL AND CHEMICALS. Neoprene jacket shields buried cable against corrosive effects of soil acids and creosoted board covers. Rugged neoprene gives *long-term* protection.



NEOPRENE RESISTS FLEX CRACKING. Some cables running between troughs are subjected to constant flex. Resilient neoprene shrugs it off, as well as abrasion, chipping and cutting.

PAST PERFORMANCE PAYS OFF!

Delaware Power and Light Company selects NEOPRENE-jacketed cables for new sub-station

Neoprene protects cable at Delaware Power & Light Company's modern Basin Road sub-station—built to handle five 69,000 volt line circuits and to act as a 69,000-12,000 KVA transformer bank for one industrial area in Wilmington.

Years of dependable service at other of the company's installations made neoprene the immediate choice when cable jacketing was selected. Experience had proved to DP&L that neoprene's unique properties withstand the host of deteriorating conditions that a cable must undergo.

Rugged and resilient, neoprene resists the attack of weather, abrasion, galvanic action, oil and chemical corrosion. No wonder DP&L feels secure in using neoprene-jacketed cable above or below ground, in ducts and conduits—*anywhere* cable is needed.

Extra-long service life—that's what it adds up to when you specify neoprene jacketing for the cable or wire you buy. And extra-long life means lowered replacement and maintenance costs. Neoprene-jacketed cable is available in single- and multiple-conductor types and in voltage ratings to meet your requirements. Ask your supplier for further details.

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Tax Reduction Not Deferral . . .

. . . is claimed by intervenors in Columbia Gas' petition for FPC order for accounting treatment of Liberalized depreciation

In proceedings in Washington, November 7th, before the Federal Power Commission, the Columbia Gas System petitioned for a declaratory order with respect to accounting and rate treatment of liberalized depreciation under the Internal Revenue Code of 1954. The intervenors in the proceedings, representing a number of cities in Kentucky, claimed that the so-called deferral arising under the liberalized methods of computing taxes was nothing but a permanent reduction of taxes and not a deferral as claimed by the petition.

Columbia's petition for a declaratory order would require normalized taxes and a reserve method of accounting for the tax deferral.

In his opening statement Richard A. Rosan, counsel for Columbia, pointed out the similarity between accelerated amortization and liberalized depreciation and the fact that the commission ruled favorably in the matter of accelerated amortization, under Opinion 264-Docket R-126 adopted on Dec. 3, 1953.

Rate Increase Opposed

The intervenors, through their counsel, Eugene F. Mullin, Jr., stated that "we oppose any increase in rates, either directly or indirectly by means of the so-called normalized or normalization of taxes. It is our position that this commission in fixing rates should consider and must consider only the actual taxes paid by the utility. Any other arrangement would be unfair, and we suggest, unlawful.

"You have expressed an interest, Mr. Examiner, as to the meaning of liberalized depreciation as contended for by counsel for the petitioners. I would say that what they contend for is liberal in the sense that it requires the consumers to make a rather liberal capital contribution to these companies."

Mullin continued "It is our position that this commission must always look only to actual taxes paid, and that to permit a company to claim that its cost of service is more than the actual taxes paid is to increase the consumers' rates and in effect force him to make a capital contribution to these companies."

The company's witness, Charles H. Mann, stated that unless, for rate making purposes, income tax expenses were computed as if the straight-line method were used, then all the advantages of the liberalized methods would disappear since there would be no additional cash generated by the company.

Deferred Taxes: How Recorded

F. Merrill Beatty, partner of Arthur Andersen and Co, testifying for the Columbia Gas System, in answer to a question by Rosan as to how the deferred taxes should be recorded, said: "In my opinion the deferred taxes should be recorded on the books as a charge to operating expense with a credit to a liability account such as proposed by the Columbia Gas System in its application. Based on the orders of 15 state commissions on the question that I know of, there is agreement with respect to the charge to operating expenses. There is disagreement with respect to where the credit for deferment of taxes should be shown.

"The orders of some commissions provide for this credit to be reflected in a reserve account, such as the companies are proposing in this proceeding and which I endorse; while other orders provide for reflecting the credits in a surplus account restricted for future federal income taxes.

"This difference in terminology does not cause me, as an accountant, any particular trouble if the restricted surplus is reflected as a liability account. However, when the surplus restricted for future federal income taxes is included in a showing of the common stockholders' equity, it does cause me trouble.

"I know of no accounting principle that will support the premise that an item of cost that is properly chargeable to operating expenses can at the same time be part of the common stockholders' equity. The whole basis for the charge to expense is that a cost has been incurred in the current period, the payment of which is deferred to a later period. The item is still a liability and, therefore, should be reflected as such, rather than included in the common stockholders' equity account."

Tax Deferral Questioned

In response to the question that certain individuals, writing on the subject of liberalized depreciation, considered that the so-called deferral is actually a permanent tax reduction, Beatty denied this contention by saying "Those who advance this view seem to agree that when you deal with a unit of property, it is clear that a deferral of taxes would have to be paid back in the latter years of the life of such property. They contend, however, that when you deal with the property as a whole, the higher depreciation deduction on subsequent additions would offset the smaller depreciation deductions in the later years of the life of the property now in existence.

"In other words, they argue that the whole is different from the sum of its parts. I think it is clear from Mr. Mann's testimony that in connection with the accounting mechanics the Columbia companies intend to account for the property additions by years, and relate the tax deferral to property by years of installation."

Tax Deferment or Reduction

Beatty continued that "My firm . . . has discussed this matter at great length . . . in deciding whether or not we felt this question was one of tax deferment or one of tax reduction—and we feel that it is a problem of a tax deferral because of the fact that when you make the election to take a larger amount of depreciation in one year, you at the same time know that you are going to have to pay a higher tax on the same year with respect to the same property.

"We think that proper accural accounting requires you to synchronize your tax provision with your depreciation provision."

There was further elaboration on the deferral controversy when Jacob Goldberg, of the commission staff, asked Beatty the following:

"Q. In your testimony yesterday, Mr. Beatty, you mentioned the fact

(*Continued on page* 168)

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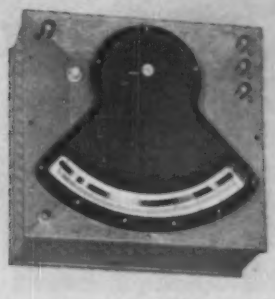

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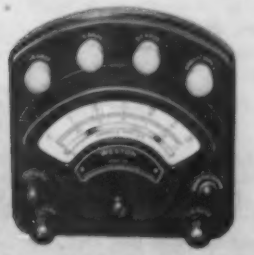

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Tax Reduction

(*Continued from page* 166)

that there were certain writers who contended that this rapid depreciation results in a tax reduction and not in a tax deferral.

"Mr. Mann mentioned Eisner of Northwestern (professor of economics of Northwestern University). Are you familiar with the Report of the Committee on Depreciation of the NARUC?

"A. Yes, I am.

"Q. I think that report concludes that it is a tax reduction and not a tax deferral, does it not, Mr. Beatty?

"A. That is one of its conclusions, yes, sir.

"Q. Would it be your view, Mr. Beatty, that if it could be shown that taking the system as a whole, there never was any charge to the reserve, would you still recommend that this reserve account be set up?

"A. I would recommend that the reserve account be set up, and I think that the mere fact that you may in the future create a new liability that happens to be larger than an existing liability, is no reason in the world why an existing liability should not be recorded.

"We have that effect in accrual accounting in many situations. The mere fact that a long term debt may be refunded 30 years from now doesn't mean that you don't record the long term debt in the interim.

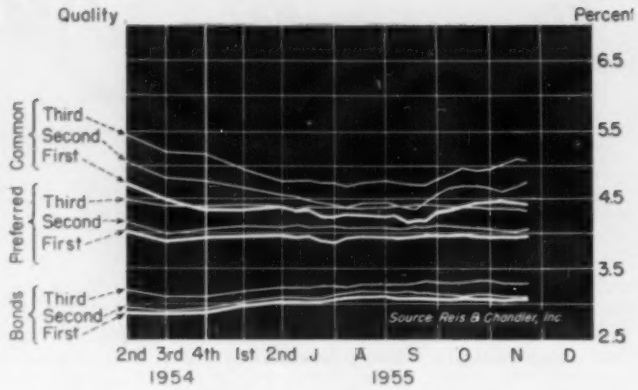
"Under accrual accounting, we have accounts payable set up all the time. We pay these accounts payable and you set up new accounts payable, but that doesn't mean that because new ones are there and that you have always got accounts payable, that you don't record it."

The hearing was recessed until Nov. 22 when the intervenors representing various Kentucky cities and the staff of the commission were planning to present their case.

Dividend Increases

Ohio Edison Co will pay Dec. 30 a quarterly common stock dividend of 62¢ a share as compared with 55¢ in the previous quarter . . . Niagara Mohawk Power Corp will pay Dec. 20 a common stock dividend of 45¢ a share versus 40¢ a share in the previous quarter.

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Nov. 17	3.08	3.10	3.27	3.97	4.04	4.35	4.42	4.77	5.14
Nov. 10	3.08	3.10	3.27	3.95	4.03	4.36	4.44	4.68	5.11

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Central Power & Light	12	Sept.	$7,059,661	$6,398,574	$	$
Columbus & Southern Ohio Electric	12	Sept.	6,380,019	5,369,295	2.30	1.88
Delaware Power & Light	12	Sept.	4,187,983	3,838,793	2.25	2.07
Interstate Power	12	Sept.	2,842,112	2,528,943	1.00	0.95
Kansas City Power & Light	12	Sept.	7,646,888	6,943,636	2.31(a)	2.29(a)
Montana Power and subsidiaries	12	Sept.	8,426,578	7,488,897	2.91	2.59
New York State Electric & Gas	12	Sept.	10,524,375	9,506,851	2.94	2.64
Niagara Mohawk Power, consolidated	12	Sept.	28,087,979	26,798,098	2.16	2.04
Northern Indiana Public Service	12	Sept.	11,501,282	9,554,270	2.76(b)	2.29(b)
Pennsylvania Power & Light	12	Sept.	21,830,959	20,778,288	3.05	2.90
Utah Power & Light	12	Sept.	6,742,515	5,415,432	3.04	2.65
Virginia Electric & Power	12	Sept.	18,897,059	15,576,274	2.52(c)	2.22(c)

Notes—(a) Based on 2,695,000 shares in 1955 and 2,450,000 shares in 1954; (b) 3,602,379 shares in 1955 and 3,509,799 shares in 1954; and (c) 6,600,000 shares in 1955 and 5,999,980 shares in 1954.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
SCHEDULE FOR NOVEMBER—DECEMBER			
BONDS			BID DATE
San Diego Gas & Electric—1st mtg due 1985	$18,000	.....	Nov. 29
Baltimore Gas & Electric—1st mtg due 1985	30,000	.....	Nov. 29
Consolidated Edison—1st mtg due 1985	70,000	.....	Dec. 6
Delaware Power & Light—1st mtg due 1985	10,000	.....	Dec. 13
PREFERRED STOCK			
Montana-Dakota Utilities—50,000 sh $100 par	$5,000	.....	Nov. 22
Virginia Electric & Power—125,000 sh $100 par	12,500	.....	Dec. 6
Delaware Power & Light—50,000 sh $100 par	5,000	.....	Dec. 13
COMMON STOCK			
Rochester Gas & Electric—200,000 sh (to be offered commonholders on 1-for-7 basis, record Nov. 25 to expire Dec. 12)	.....	.....	.....
Columbus & Southern Ohio Electric—250,000	.....	.....	Dec. 6 (a)

Note—Underwriters (a) Dillon, Read & Co.

STATISTICS

'55 a Big Year for Major Appliances

Here's a comparison of the first nine months of '55 and the first nine months of '54

Appliance	1954	1955	Gain	
Electric Dryers	376,282	667,897	291,615	Up 77.5%
Dishwashers	141,066	212,500	71,434	Up 50.6%
Washing Machines	1,695,790	2,269,024	573,234	Up 33.8%
Television Sets	4,733,315	5,760,506	1,027,191	Up 21.7%
Refrigerators	2,728,641	3,210,337	481,696	Up 17.7%
Electric Ranges	843,699	979,888	136,189	Up 16.1%
Water Heaters	476,079	551,050	74,971	Up 15.7%
Food Freezers	534,491	579,059	44,568	Up 8.3%

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Sept.	110.91	110.03	99.16	11.8
Peak—Class I Systems (million kw)	Aug.	91.6	89.3	79.7	14.9
Estimated Dec. '55 Peak (million kw)	Aug.	96.54	96.30	95.95	0.6
Production—billion kwhr	Sept.	46.34	49.35	39.55	17.2
Hydro		8.17	9.53	7.80	4.7
Fuel		38.18	39.82	31.74	20.3
Sales—billion kwhr	Aug.	43.44	40.89	36.28	19.7
Residential		10.46	9.89	9.30	12.5
Commercial		7.39	6.92	6.56	12.7
Industrial		22.84	21.50	17.80	28.3
Other		2.74	2.59	2.62	4.6
Fuel Consumption	Sept.				
Coal—million tons		12.06	12.59	9.72	24.1
Oil—million barrels		5.18	5.37	4.90	5.7
Gas—billion cu ft		120.17	132.55	118.62	1.3
Net Income Class A & B Co's—$ million	Aug.	93.95	89.87	88.98	5.6
Residential Customers—millions	12 mos.	43.96	43.83	42.69	3.0
Revenue per kwhr	ended	2.66¢	2.66¢	2.71¢	−1.9
Avg kwhr per customer	Aug. 31	2,682	2,662	2,478	8.2
Avg annual bill		$71.34	$70.81	$67.15	6.2

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Sept.	141	139	126	11.9
ENR Construction Cost	Oct.	141.2	141.0	134.6	4.9
BLS Cost-of-living	Sept.	114.9	114.5	114.7	0.2
NEMA Sales	Aug.				
Insulation materials		147	117	111	32.4
Electric appliances		111	97	91	22.0
Household refrigerators		86	89	71	21.1
Wholesale prices	Oct.				
Motors and generators		125.3	125.1	121.8	2.9
Transformers and regulators		129.2	129.2	128.1	0.9
Switchgear and fuses		146.3	146.1	135.1	8.3
GNP—annual rate—$ billion	3rd Qtr.	392.0	384.8	358.8	9.3

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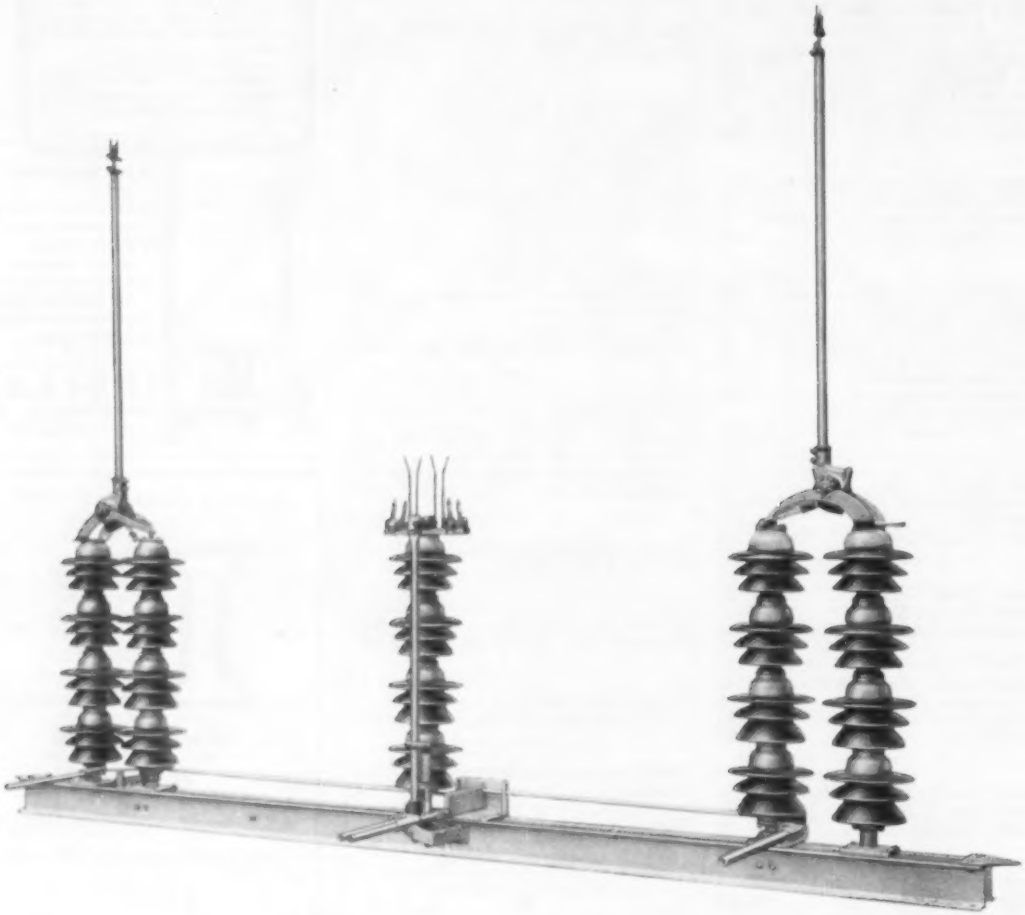

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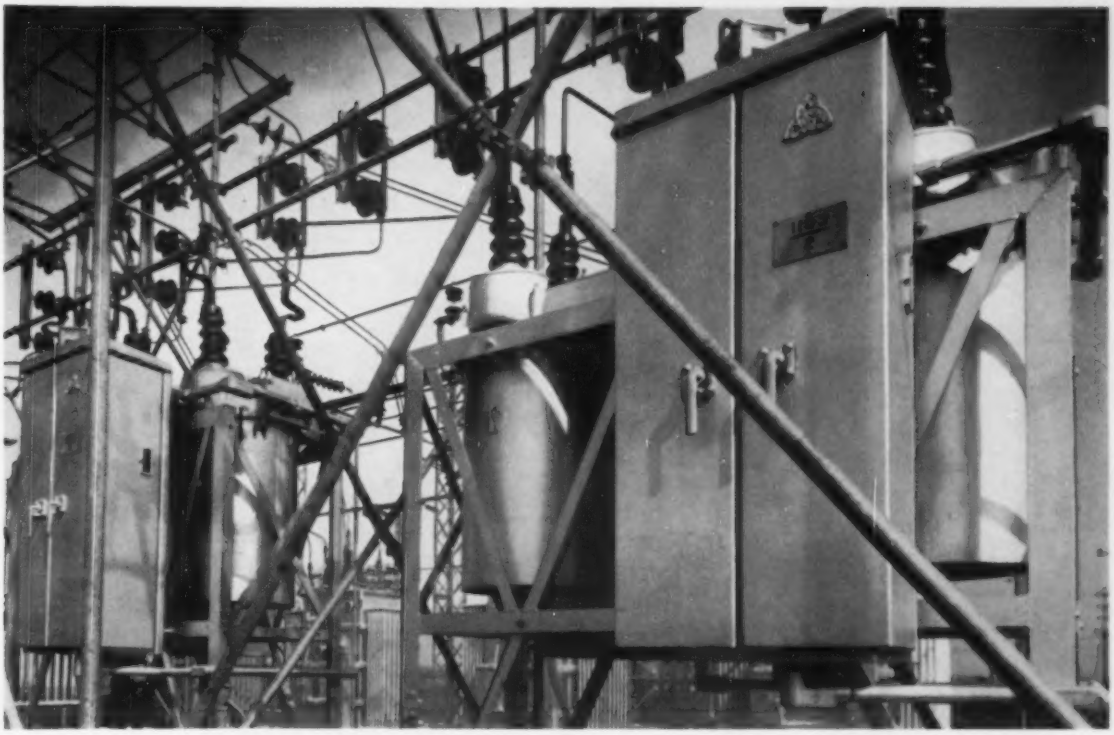

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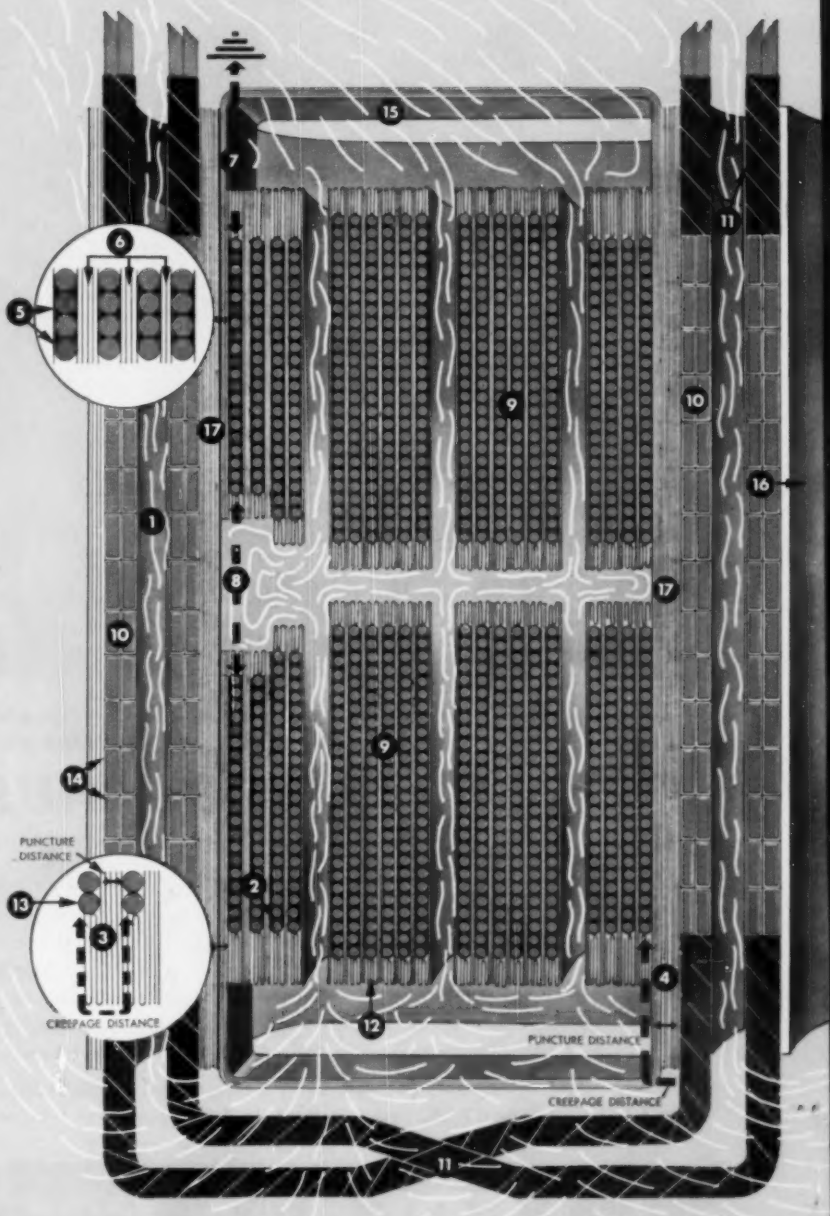

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